

## What We Do

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Allegan County GIS  
[www.allegancounty.org/gis](http://www.allegancounty.org/gis)

October 24, 2018

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# **Part I**

# **Brand**

# Chapter 1

## Awards

### 1.1 The GIS Champion Award

#### 1.1.1 GIS Champion Award Code

```
\documentclass[landscape]{article}
\usepackage{wallpaper}
\usepackage{niceframe}
\usepackage{xcolor}
\usepackage{ulem}
\usepackage{graphicx}
\usepackage{geometry}
%geometry{tmargin=.75cm,bmargin=.25cm,
%lmargin=.8cm,rmargin=.2cm}
\geometry{tmargin=.25in,bmargin=.25in,
  lmargin=.25in,rmargin=.25in}
\usepackage{multicol}
\setlength{\columnseprule}{0.4pt}
\columnwidth=0.3\textwidth

\begin{document}
\centering
\scalebox{2.9}{
\color{green!30!black!60}
\begin{minipage}{.33\textwidth}
\font\border=umrandb
\generalframe
{\border \char113} % up left
{\border \char109} % up
{\border \char112} % up right
{\border \char108} % left
{\border \char110} % right

```

```
{\border \char114} % lower left  
\border \char111} % bottom  
\border \char115} % lower right  
\centering  
\includegraphics[height=1.5cm]{GIS_Logo_better.jpg}  
  
\vspace{-8mm}  
  
\curlyframe[.9\columnwidth]{  
  
    \textcolor{green!10!black!90}{  
        {\small Allegan County GIS Services}  
        \vspace{.005in}  
  
        \textcolor{green!10!black!90}{  
            \tiny Recognizes}\\"  
        \%\\smallskip  
        \vspace{.005in}  
        \underline{\textcolor{green!30!black!60}{  
            \textcolor{green!30!black!60}{Brian Redmond}}}  
        \\  
        \%\\smallskip  
        \tiny Information Services Technician  
  
        \%\\smallskip  
        \textcolor{green!10!black!90}{  
            {  
                \\  
                \tiny for Excellence in  
            }  
            \%\\smallskip  
            \\  
            \textcolor{black}{\normalsize \textsc{Enabling  
                Employee Experiences}}  
            \\  
            \vspace{.1in}  
            \textcolor{green!10!black!90}{  
                {  
                    \tiny on this day  
                    \itshape September 21, 2018  
                }  
  
                \vspace{.1in}  
                {\color{green!10!black!90}  
                    \scalebox{.6}{
```

```
\begin{tabular}{ccc}
\cline{1-1}
\cline{3-3}
\\
Neil Besteman & & Bryan May \\
GIS Manager & & GIS Analyst \\
\end{tabular}

} % closes scalebox{.6} arg
} % closes blue!40!black
} % closes curlyframe arg
} % closes centering
\end{minipage}
} % closes scalebox{2.8} arg

\end{document}
```

## **Part II**

# **Methods**

# Chapter 2

## Documentation

### 2.1 About Documentation

#### 2.1.1 How Jalapeño Works

General Notes:

- jalapeno folder is a git package.  
<https://github.com/nbesteman/jalapeno>

- Project is coded with relative paths and jalapeno can be located anywhere.

Project file structure:

...\\jalapeno\\..	
folder	description
documentation	resources used in Jalapeño
processing	.tex documents and build folders
source	common image files

...\\jalapeno\\documentation\\..	
folder or file	description
moduleTemplates	.tex templates
packageDocs	L <small>A</small> T <small>E</small> X documentation
references	reference and appendix resources
unsorted	catch all for unsorted documentation
BookStructureMM.mm	A mindmap of jalapeno

...\\jalapeno\\processing\\..

folder or file	description
...Part	folders of book <i>parts</i>
build	L <sup>A</sup> T <sub>E</sub> X folder for .pdf output and temp files
build\referenceEntries.bib	entries that appear in references
commonTitle.tex	code for all title pages
fullCompile.sh	shell script to compile GISDocumentation.tex
GISDocumentation.tex	master document code
glossaryEntries.tex	entries that appear in glossary
indexEntries.tex	entries that appear in the index
preamble.tex	preamble code for all documents

**\*Note about referenceEntries.bib** Any reference entries built here can be cited in any .tex document in the project.

## Using the glossary

**Glossary requirements:** Glossary commands require a Perl interpreter. Activeperl is a free Perl interpreter and can be downloaded from:

<https://www.activestate.com/activeperl/downloads> (A typical installation adds Perl to your path). Compiling the glossary requires running the makeglossaries command either in a L<sup>A</sup>T<sub>E</sub>X IDE or in command line as described here. PDFLatex must be run first to create a .aux file that is used by makeglossaries to create an .glx file. After the .glx file is created, PDFLatex must be run again to insert the glossary at the \printglossaries location.

**Creating a new glossary entry** To create a new glossary entry: Add an entry to glossaryEntries.tex. Save it there and then use the makeglossaries command to recompile the .glx file.

**Rebuilding the glossary** To Recompile the .glx. In the (main document)build folder:

- Launch command prompt
- enter command: **makeglossaries GISDocumentation\***

**\*Note:** This command reads the .aux file and creates the .glx file. The .aux file is created by compiling with PDFLatex. If there is no .aux file the command will fail.

**Using glossary terms in a subdocument:** In the subdocument you must add code to input the glossaryEntries file. For example:

After the line:

```
\input{../../preamble}
```

Add the line:

```
\input{../../glossaryEntries}
```

**To use a glossary term in the subdocument:**

In place of the term, use code referencing the key (in the glossaryEntries file):

- `\gls{key}`

**To add the glossary to the subdocument:**

- Add the line `\makeglossaries` to the preamble of the subdocument.
- Add the line `\printglossaries` to the subdocument.
- Run `makeglossaries` in command line on the subdocument similar to how is described above.

## Using the bibliography(References)

**Bibliography requirements:** Compiling the bibliography requires running `bibtex` either in a L<sup>A</sup>T<sub>E</sub>X IDE or in command line as described here. PDFLatex must be run first to create a `.aux` file that is used by `bibtex` to create a `.bbl` file. After the `.bbl` file is created, PDFLatex must be run again to insert the bibliography at the `\bibliography` location.

For example, the command:`...\bibliography{referenceEntries}`  
...places the bibliography called `referenceEntries.bib` which must be in the same folder as the project `.aux` file.

**Creating a new bibliography entry** To **create a new bibliography entry:** Add an entry to `referenceEntries.bib`. Save it there and then use `bibtex` to recompile the `.bbl` file.

**Rebuilding the bibliography** To **Recompile the .bbl**. In the (main document)build folder:

- Launch command prompt
- enter command: **bibtex GISDocumentation**

**\*Note:** This command reads the `.aux` file and creates the `.bbl` file. The `.aux` file is created by compiling with PDFLatex. If there is no `.aux` file the command will fail.

**To cite a bibliography source in a subdocument:**

In the place that you want the citation:

- `\cite[pg.#]{key}`

**To add the bibliography to the subdocument:**

- Similar to adding to the master document but not documented here.

## Using the Index

**Index requirements:** Compiling the index requires running the makeindex command either in a L<sup>A</sup>T<sub>E</sub>X IDE or in command line as described here. PDFLatex must be run first to create a .aux file that is used by makeindex to create an .idx file. After the .idx file is created, PDFLatex must be run again to insert the index at the \printindex location.

**Creating a new index entry To create a new index entry:** Add an entry to indexEntries.tex. Save it there and then use the makeindex command to recompile the .idx file.

### Rebuilding the index

**To Recompile the .idx** In the (main document)build folder:

- Launch command prompt
- enter command: **makeindex GISDocumentation\***

**\*Note:** This command reads the .aux file and creates the .idx file. The .aux file is created by compiling with PDFLatex. If there is no .aux file the command will fail. Run PDFLatex first

**Using index terms in a subdocument:** In the subdocument you must add code to input the indexEntries file. For example:

After the line:

```
\input{../../preamble}
```

Add the line:

```
\input{../../indexEntries}
```

**To use a index term in the subdocument:**

In place of the term, use code referencing the key (in the indexEntries file):

- \index {key}

**To add the index to the subdocument:**

- Add the line \makeindex to the preamble of the subdocument.
- Add the line \printindex to the subdocument.
- Run makeindex in command line on the subdocument similar to how is described above.

## Using the Appendices

## 2.2 Document Storage Concepts

### 2.2.1 GIS File Standard

**Folders inside the project folder**

Lets talk about map projection

- archive
- build
- delivered
- documentation
- processing
- source

# **Chapter 3**

# **Team Concept**

## **3.1 Team Structure**

### **3.1.1 Paired Programming**

A paragraph about pp from Joy Inc.

# **Part III**

# **Service**

# Chapter 4

# Applications

## 4.1 Applications for Treasurer Dept.

### 4.1.1 Forfeiture Data Collection

#### Problem and Analysis

**Background** Treasurer department has an annual responsibility to properly document the tax forfeiture process. The LIS Department built an application in MS Access and MapInfo that consumed a daily export from BSA and was deployed to the field on a laptop. A digital camera was used for site photos and later imported into the laptop.

**Statement of Problem** Current Tax Forfeiture workflow is built on MapInfo software which has been replaced by ESRI software. The Forfeiture data collection application must be recreated in the ESRI framework.

**Analysis** Tax Forfeiture Application will facilitate:

- Mobile data collection on handheld device via Collector for ArcGIS configured with Allegan County GIS Portal (**device app**)
  - Device app will:
    - \* Synchronize with data in the office (online)
    - \* Navigate to forfeiture sites (offline)
    - \* Collect data and photos of forfeiture sites (offline)
    - \* Synchronize the collected data with data in the office (online)
- Daily form production and printing for each site visited with required data and images.

## Design

**Overview** This Application utilizes Treasurer Department data to document the forfeiture process. An enterprise GIS deployment enables offline data collection by up to two users.

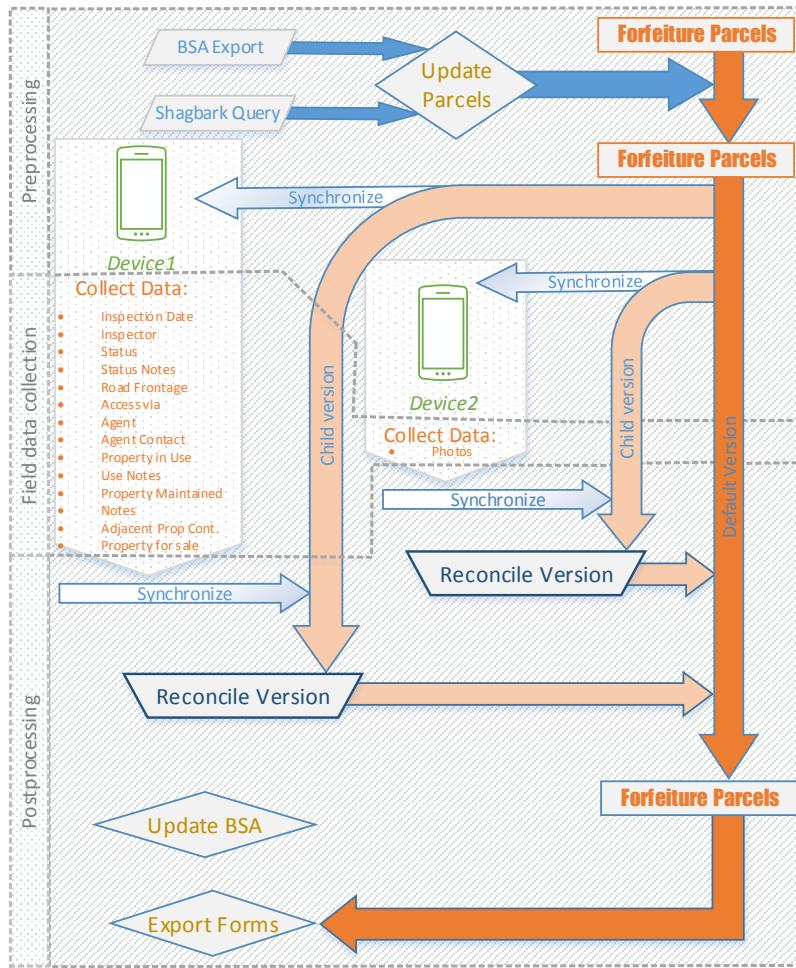


Figure 4.1: Project Design

There are three stages to daily workflow: Preprocessing, Field Collection, and Postprocessing. Forfeiture Parcels, is a map feature class that is processed in the office via the network and remotely via the internet.

### Workflow Summary

**Preprocessing** The data is updated to match the Treasures data in BSAforfeiture.net and check for intersections with known contamination sites. Data is then synchronized to two android mobile devices.

**Field data collection** The two mobile devices are used to collect info required, one for all the attributes, the other for photos.

**Postprocessing** The mobile devices are syncronized back to the network data and a form is exported for each site visited that day.

### Technologies Used

**BSA Data** Details of parcels in the forfeiture process are managed in BSA Delinquent Tax.net. The Treasurer office does a BSA export of the parcels in need of a site visit in the preprocessing.

**ArcGIS Desktop** Tools are designed to preprocess and postprocess forfeiture parcel data for fieldwork. The user will execute a preprocess script tool that prepares the data for field deployment. After fieldwork, a post process script tool syncronizes data from the fieldwork with the live data on the Allegan County network.

**ArcGIS Collector** A free mobile application developed and tested on Android is deployed to the field for data collection. The application is configured to work offline(without an internet or cellular connection) by syncronizing before and after fieldwork.

**ArcGIS Portal Webmaps and Apps** Live data from a publishing enterprise geodatabase(ACPub), running on SQL Server database server (acintsql01) is provided through a feature service (REST service) named TaxReversion-Parcels. A webmap called the Forfeiture Field Map consumes the TaxReversionParcels feature service, exposing the data to editing. The Forfeiture Field Map is configured to work in the ArcGIS Collector App. The app downloads the webmap, allowing the user to collect the necessary information on each forfeiture parcel in the field disconnected, and then to upload the changes when reconnected.

**Forfeiture Mobile Data Collection App in Action** Three parts of the daily routine:

1. Preprocessing (in the office):

- Export current forfeiture list from BSA

- Update webmap layers with results from BSA export
- Update webmap layers with results of an intersect routine with contaminated sites
- Synchronize from webmap layers to field collection devices (**device app**)

2. Field data collection with device app:

- Navigation to forfeiture sites is aided by users location shown in map
- A Checklist of data points about the site
- Attach photos to the site
- Save results for synchronization in post-processing

3. Post-processing (in the office)

- Synchronize data and images collected in device app to webmap layers

## Data Details

**Location** The data is located in AC PUB. AC PUB is a geodatabase on ACINTSQL01.

### Forfeiture Parcels Data

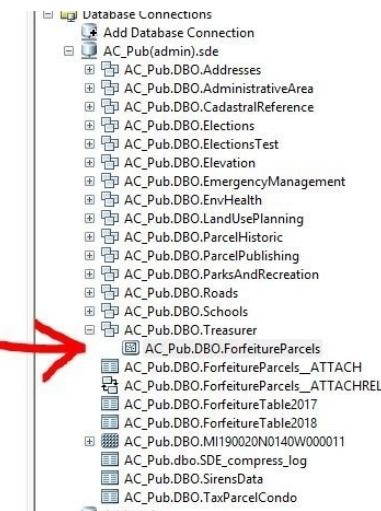


Figure 4.2: Live Data Location

### Contamination Data

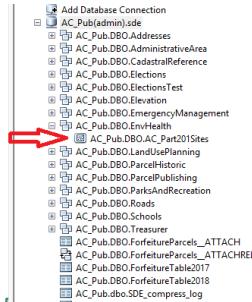


Figure 4.3: Contamination Feature Class

Attribute List			
Field Name	Field Alias	Entry Type	Note
PropertyNumber	Property Number	Prefilled	NA
Need2Print	Print Today	Dropdown	Yes or No
InspectionDate	InspectionDate	Autofill or Dropdown	NA
Inspector	Inspector	Dropdown	NA
Address	Address	Prefilled	NA
Status	Status	Dropdown	NA
StatusNotes	Status Notes	Open Entry	120Char
Roadfrontage	Road Frontage	Dropdown	Yes or No
AccessVia	Access via	Open Entry	30Char
Agent	Agent	Open Entry	30Char
AgentContact	Agent Contact	Open Entry	30Char
UseNotes	Use Notes	Open Entry	120Char
PropMaintNotes	Property Maintained Notes	Open Entry	120Char
PropertyForSale	Property for sale	Dropdown	Yes or No
Posted	Posted	Prefilled	NA
InList	In List	Prefilled	in Preproc
PostedInList	PostedInList	Prefilled	in Preproc
Acres	Acres	Prefilled	NA
Class	Class	Prefilled	NA
PropertyInUse	Property In Use	Dropdown	Yes or No
PropertyMaintained	Property Maintained	Dropdown	Yes or No
PropertyContaminated	Property Contaminated	Prefilled	in Preproc
Notes	Notes	Open Entry	120Char
AdjacentPropertyContaminated	Adjacent Property Contaminated	Prefilled	in Preproc
PropertyContaminatedNotes	PropertyContaminatedNotes	Prefilled	in Preproc
AdjPropertyContaminatedNotes	AdjPropertyContaminatedNotes	Prefilled	in Preproc
PictureComments	Picture1Comments	Open Entry	50Char
PostedDate	PostedDate	Dropdown	Date

Table 4.1: Dataset Details

**ForfeitureParcels Feature Class**

**Webmap Details** The Forfeiture Field Map can be accessed on PC through the Allegan County GIS Portal. The map is made up of a basemap and a feature layer.

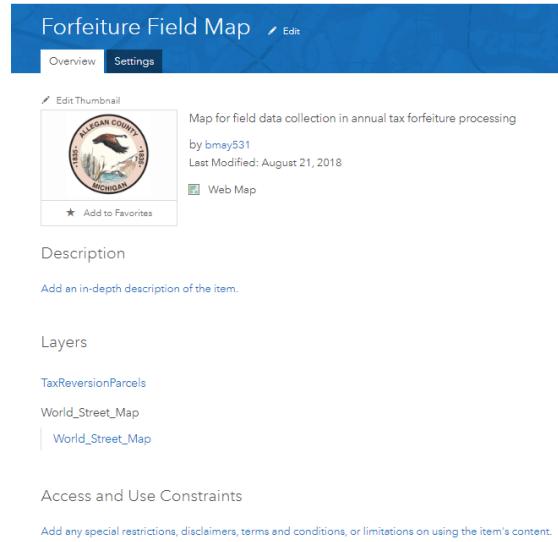


Figure 4.4: Web Map Details

**Feature Layer Details** The webmap consists of a basemap and a feature layer, TaxReversionParcels. TaxReversionParcels has been configured for offline use.

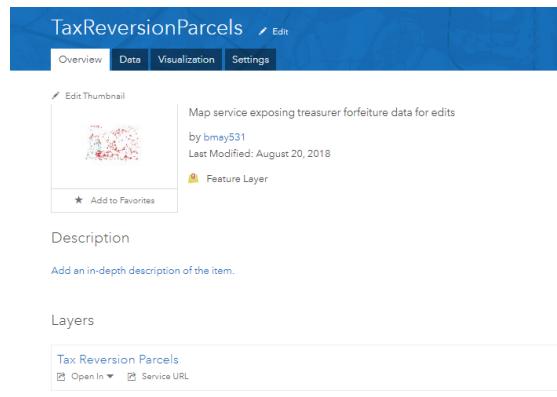


Figure 4.5: Layer Details

**Basemap Details** A tiled basemap service is used. The infoserv user credentials are used for sharing. The url for the shared service is:

[https://tiledbasemaps.arcgis.com/arcgis/rest/services/World\\_Street\\_Map/MapServer](https://tiledbasemaps.arcgis.com/arcgis/rest/services/World_Street_Map/MapServer)

The screenshot shows the ArcGIS Online interface for the 'World Street Map (for Export)' layer. At the top, there are navigation links: ArcGIS, Pricing, Map, Scene, Help, and a Sign In button. Below the header is a search bar. The main title is 'World Street Map (for Export)'. Underneath the title is a 'Overview' tab. To the right of the overview is a map thumbnail showing a small area of the world map with a red bounding box around a specific location. Below the map is a link 'View Layer by Esri'. To the right of the map are three buttons: 'Open in Map Viewer', 'Open in Scene Viewer', and 'Open in ArcGIS Desktop'. Below these buttons is a 'Details' section with a 'Source: Map Service' link and a size indicator 'Size: 1 kb'. There are also social sharing icons for Facebook, Twitter, and LinkedIn. Further down is an 'Owner' section with a profile picture and the name 'esri'. The 'Tags' section lists various geographical terms like 'World', 'Global', 'Europe', etc. At the bottom of the page, there is a 'Service Information for Developers' section with instructions for exporting tiles.

Figure 4.6: Basemap Source Description

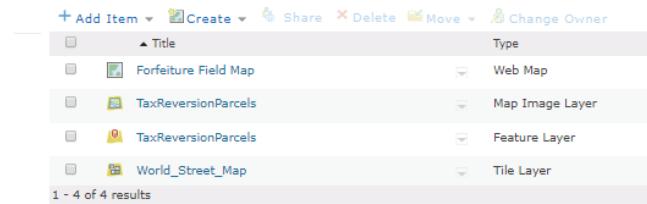


Figure 4.7: Portal Contents

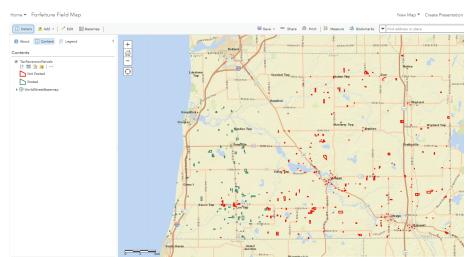


Figure 4.8: Field Map on PC

unplaced images

**Hard Copy Record**

screenshots: arcmap map arcmap tools portal screenshots sql server mgt screen shots phone screenshots

**ArcGIS Server**

xx

**User Manual****Administrative Tasks****Annual Setup**

**Setup Users in ArcGIS** Users that will run Pre and Post processing scripts must be created and given privileges on ACPub Treasurer Feature Data Set.

**Setup Users in Portal for ArcGIS** Users that will use the Collector for ArcGIS must have profiles added to and managed in the Allegan County GIS Portal site.

**Schema Change Procedure****Form Edits Procedure**

### Collection Device Setup

#### Collector Application Setup Details

##### Install Collector for ArcGIS

- Available from the Google Play Store



Figure 4.9: Download the App

### Configure Collector

for Organization Website, Type:

`https://gis.allegancounty.org/  
portal_webadaptor`

then:

Press Continue Enter Cre-

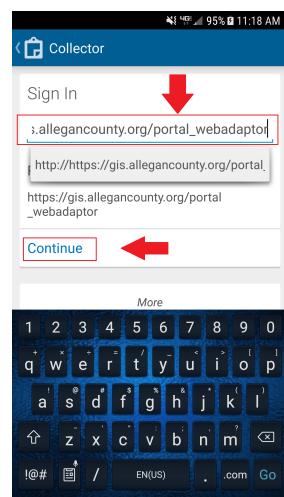


Figure 4.10: Collector Connection

dentials

then:

Press SIGN IN

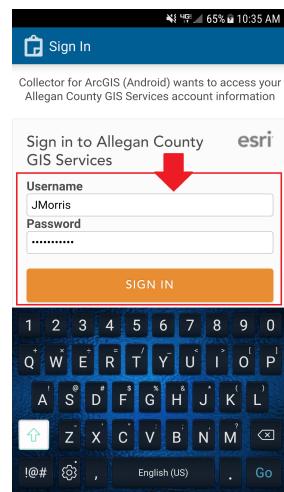


Figure 4.11: Enter Credentials

**Download the Forfeiture Field Map** There are 3 different versions of the map.

- Forfeiture Field Map
- Forfeiture Field Map For Photos
- Forfeiture Field Map For Attributes

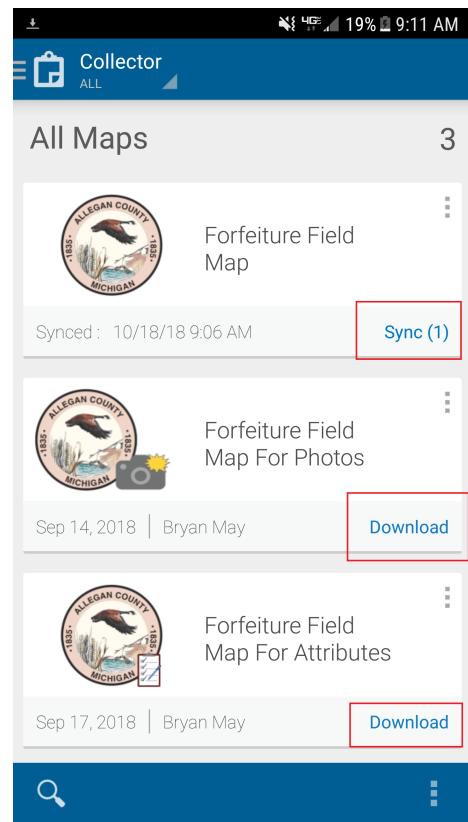


Figure 4.12: Collector Maps Menu

The Download option indicates it is not on the device but is available for offline use.

Press Download

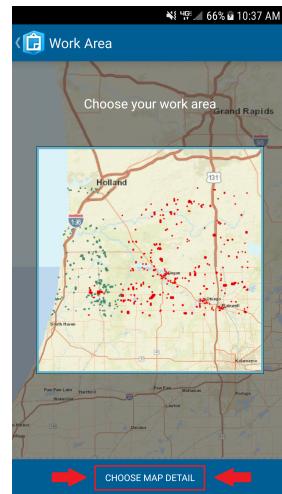


Figure 4.13: Choose Work Area (large)

Specify work area to download and press map detail

Note that a larger area takes longer to download but the basemap only needs to be downloaded once.

### Choose Map Detail

Zoom into the level of detail desired.

Press Download

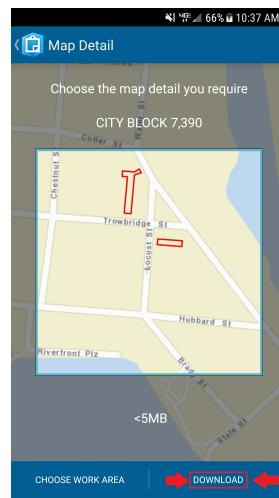


Figure 4.14: Choose Map Detail

This area is ready for field data collection.

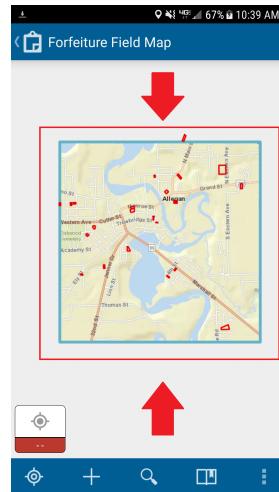


Figure 4.15: Map on Device

### Open Camera Application Setup Details

#### Install Open Camera

- Available from the Google Play Store

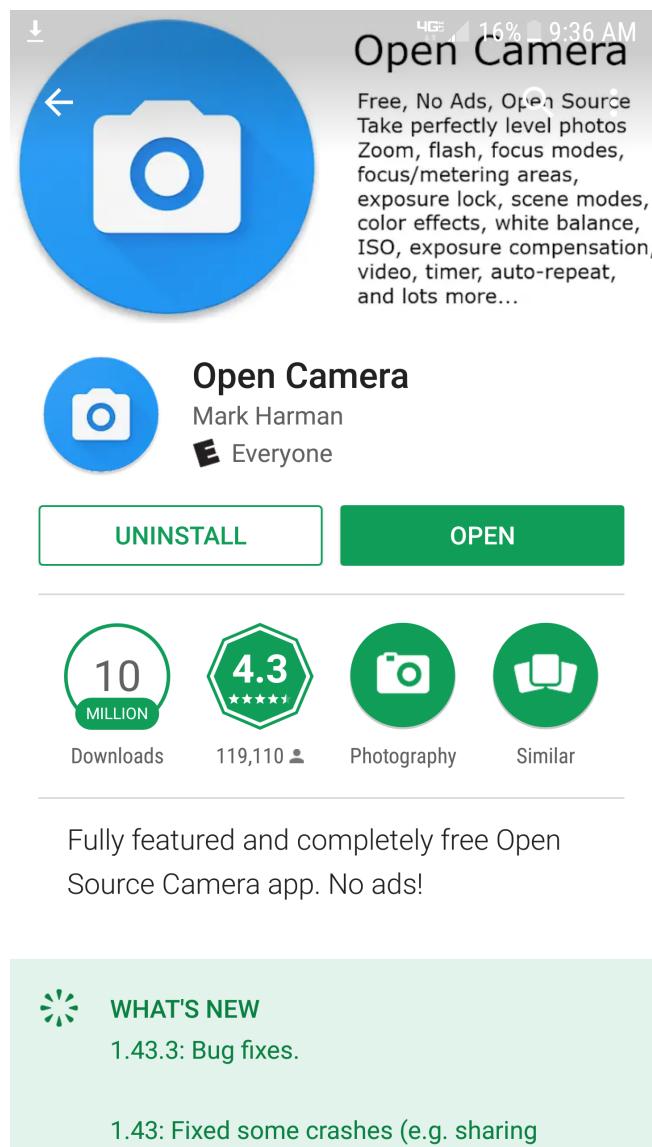


Figure 4.16: Open Camera from Google Play Store

### Configure Open Camera

In the Open Camera Application:  
Press the gear shaped Settings

button to go into the settings menu

Press the Photo Settings but-

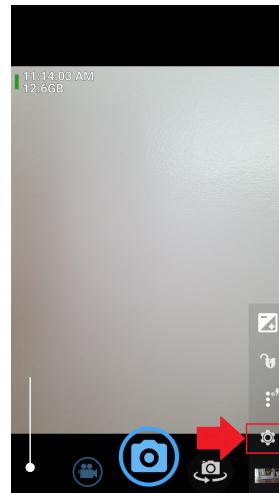


Figure 4.17: Find Settings Menu

ton

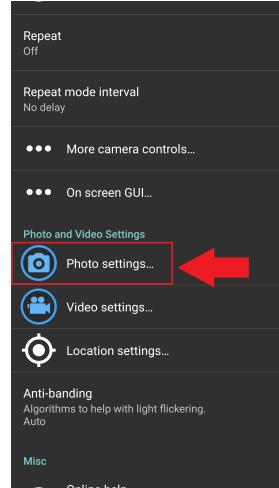


Figure 4.18: Setting Screen

### Set Photo Resolution

In photo settings:  
Press the Camera resolu-

tion button  
Select **640 x 480**

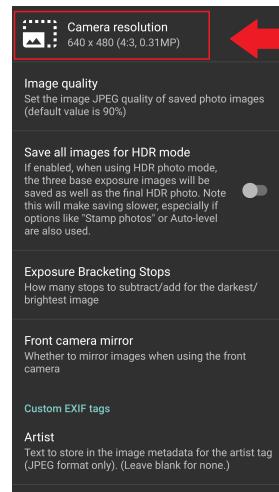


Figure 4.19: Photo Settings Menu

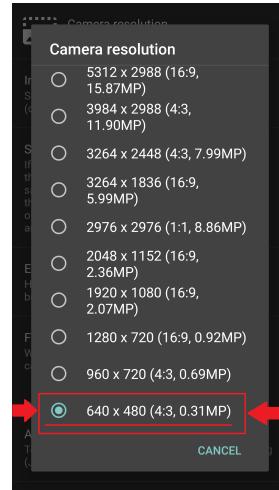


Figure 4.20: Camera Resolution Setting

### Daily Preprocessing Routine

**Execute Preprocessing Script** A tool in ArcGIS that:

- Exports current forfeiture list from BSA
- Updates webmap layers with results from BSA export

In Catalog:

Open the tool-

box  
Open tool 1

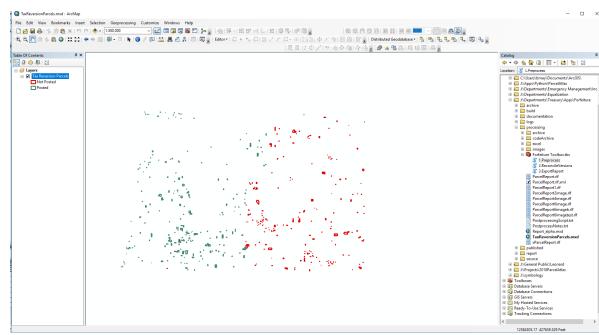


Figure 4.21: Processing Tools

**Synchronize the Forfeiture Field Map**

Note the date and time:  
Press Sync Note the date

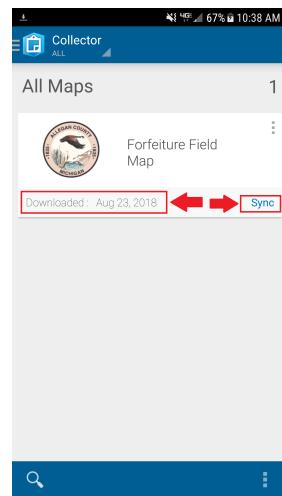


Figure 4.22: Map Downloaded

---

and time Map is now syn-

chronized

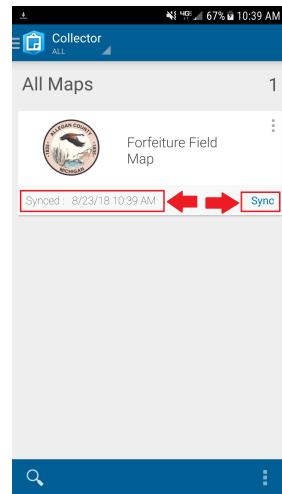


Figure 4.23: Map Synchronized

**Forfeiture Data Collection**

**Forfeiture Parcels Data Details** Attributes are of four entry types:

- prefilled
- autofill
- dropdown
- text box

For each site visited, select the desired parcel, push the edit button and collect attributes. If the boxes are autofill, select from dropdown or typed.

**Device 1 Field Operation** Device one data collection interface, used to add data to all of the boxes

In the Forfeiture Field Map, for each site visited:  
**Select the desired parcel**

Push the edit button



Figure 4.24: Select Parcel

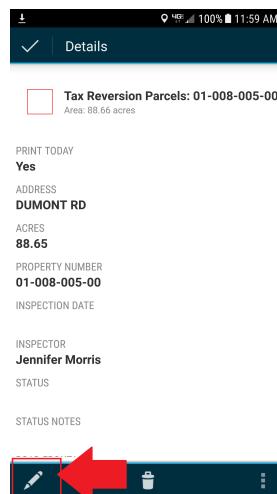


Figure 4.25: Parcel Details

Class prefilled Acres prefilled

**Device 1 Field Operation Cont.**

Select Yes for Print Today

Select Use Current or en-



Figure 4.26: Print Today Yes or No

ter any date

Select Inspector From

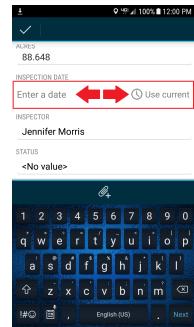


Figure 4.27: Enter Date

Dropdown



Figure 4.28: Select Inspector

### Device 1 Field Operation Cont.

Select Occupied or Not Occupied  
Enter status notes up to



Figure 4.29: Status

120 characters  
Select Yes or No for Road

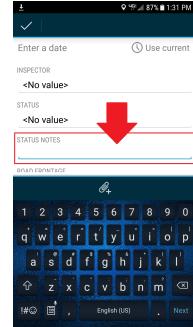


Figure 4.30: Status Notes

Frontage

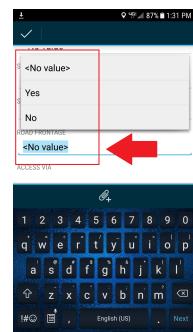


Figure 4.31: Road Frontage

**Device 1 Field Operation**  
 Cont. Enter road used for access

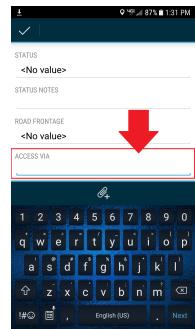


Figure 4.32: Access Via

Enter Agent Name

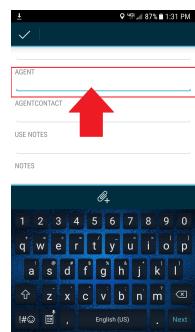


Figure 4.33: Agent

Enter Agent Contact Info

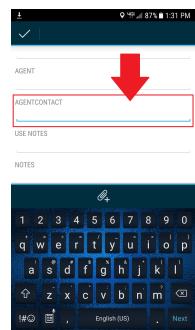


Figure 4.34: Agent Contact

**Device 1 Field Operation Cont.**

Enter Use Notes up to 120 characters

Enter Notes up to 120

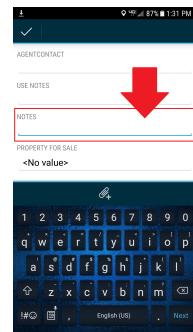


Figure 4.35: Use Notes

characters

Enter property for sale yes

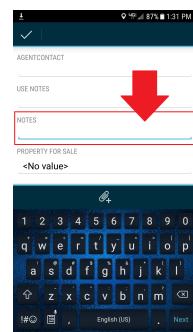


Figure 4.36: Notes

or no

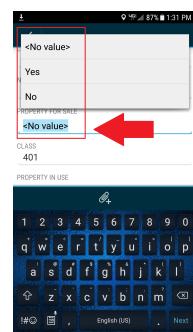


Figure 4.37: Property for Sale

**Device 1 Field Operation Cont.**

Property in Use Yes or No

Adjacent Property Con-

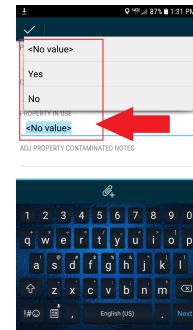


Figure 4.38: Property in Use

taminated Notes up to 120 characters

Property Contaminated

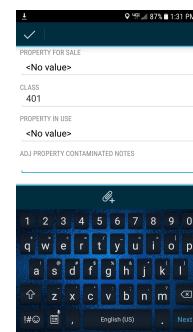


Figure 4.39: Adjacent Property Contaminated Notes

yes or no prefilled

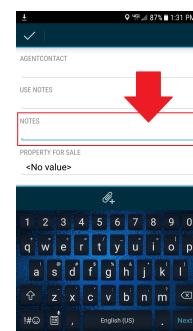


Figure 4.40: Property Contaminated

**Device 1 Field Operation Cont.**

Enter notes up to 120 characters

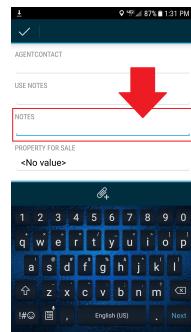


Figure 4.41: Notes up to 120 characters

Adjacent Property Contaminated yes or no pre-filled

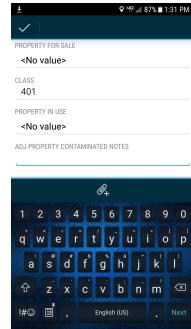


Figure 4.42: Adjacent Property Contaminated

Enter Property Contaminated notes up to 120 characters

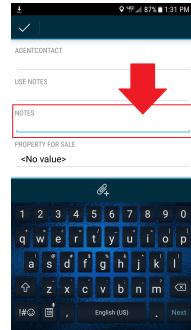


Figure 4.43: Property Contaminated

**Device 1 Field Operation Cont.**

Property Maintained Yes  
or No

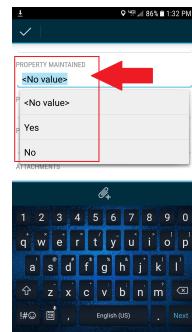


Figure 4.44: Property Maintained

Picture Comments up to  
120 characters

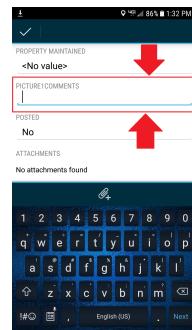


Figure 4.45: Picture Comments

Placeholder

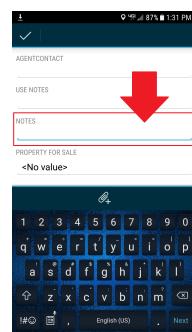


Figure 4.46: Placeholder

**Device 2 Field Operation** In the Forfeiture Field Map, for each site visited, a photo or photos can be added from the Open Camera Application.

Select a parcel from the map



Figure 4.47: Select Parcel

Push Attachment Button

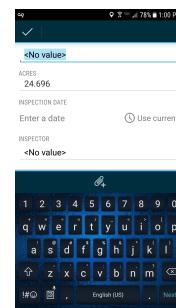


Figure 4.48: Push Attachment Button

Select Gallery

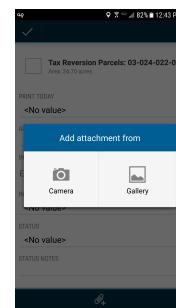


Figure 4.49: Add Attachment From Gallery

### Device 2 Field Operation Cont.

Navigate to the Open Camera Folder

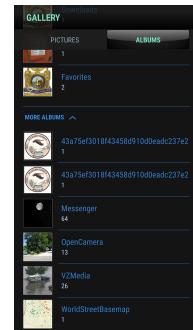


Figure 4.50: Open Camera Folder

From within the Open Camera Folder, Select the appropriate image



Figure 4.51: In the Open Camera Folder

Press the check button to save the image to the parcel

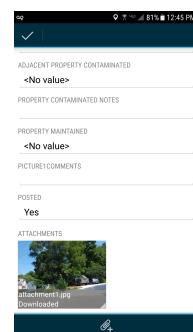


Figure 4.52: Image in the App

**Daily Postprocessing Routine** Back at the office

**Synchronize Webmap** In Collector for ArcGIS, push the sync button on the Forfeiture Field Map

**Execute Postprocessing Script** A tool in ArcGIS that:

- Reconciles geodatabase versions
- Generates forms for each site visited

**Software****ESRI Licensed Products**

**ArcDesktop** Users of this application need a license to ArcGIS Standard level.

**Enterprise ArcGIS Deployment** This app uses ArcGIS Server and ArcGIS Portal.

**Collector for ArcGIS** Developed and tested on Android(7.0). Collector is available at the Google Play Store.

**Other Software**

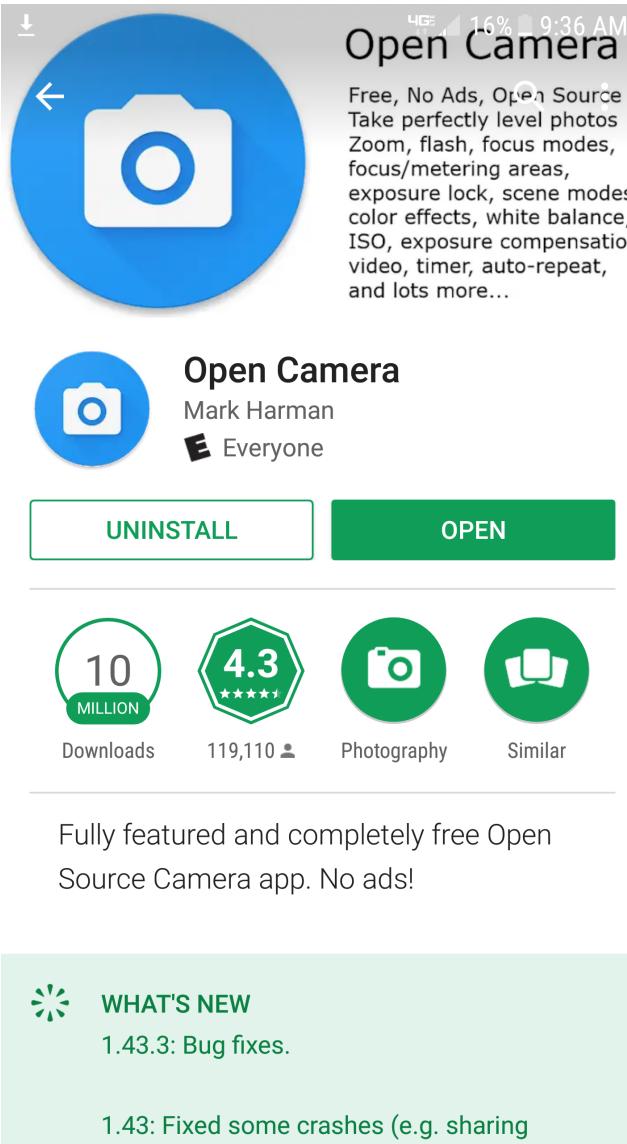


Figure 4.53: Open Camera from Google Play Store

# Chapter 5

## Tools

### 5.1 Core Data

#### 5.1.1 Control Points

Maintaining Cadastral Control Points

Steps

```
Identify position of new control point
Place Target Point
Update Target Point attributes to associated fabric point OID
Push move point button
Zoom to Control point
Open maintain control point tool
Select control Point
edit button
copy x and y value from
identify tool x and y of points
update button
```

## **5.2 ESRI Tools**

### **5.2.1 COGO Tools in ArcGIS**

TEXT

## 5.3 GIS Administration

### 5.3.1 New Connections in ArcCatalog

#### New Database Connection in ArcCatalog

##### In Catalog:

Double click on add database connection

NOTE

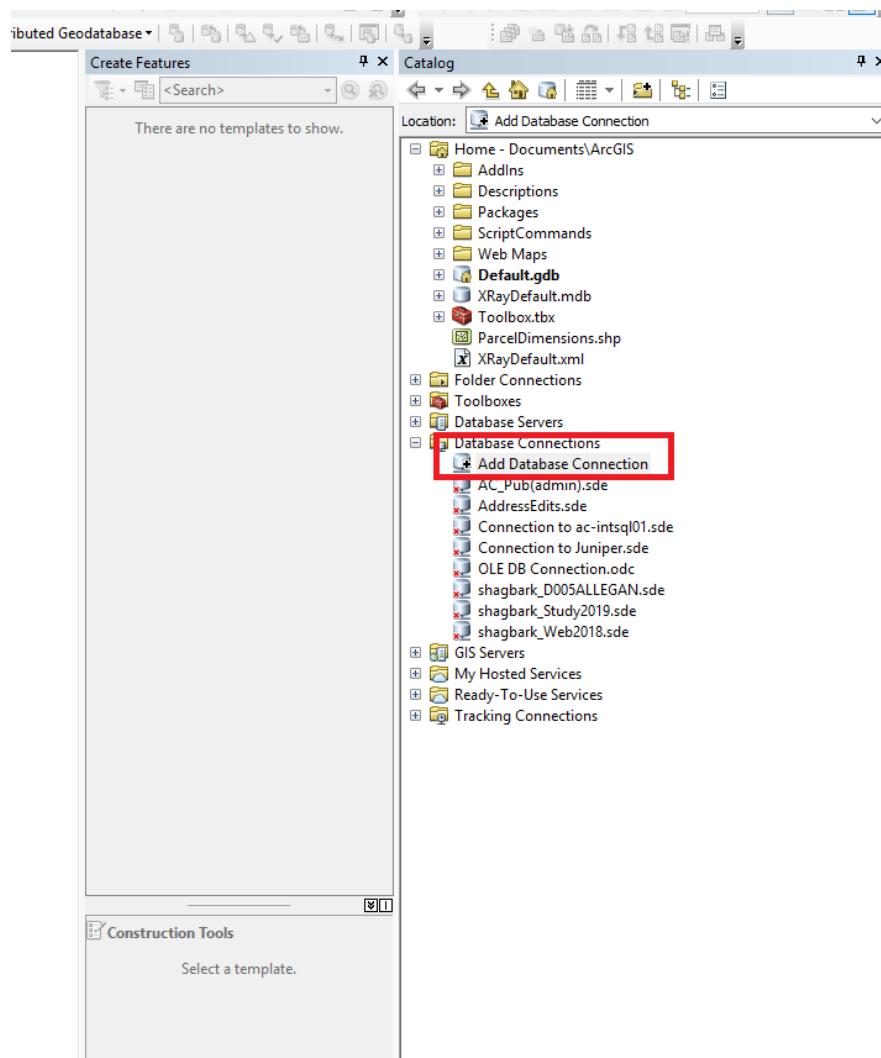


Figure 5.1: Catalog Add Db Connection

## New Connection Dialog

Enter into the tool

- Select Database Platform
- Enter Instance Name
- Enter user name and password
- Check Save user name and password
- Select Database in dropdown

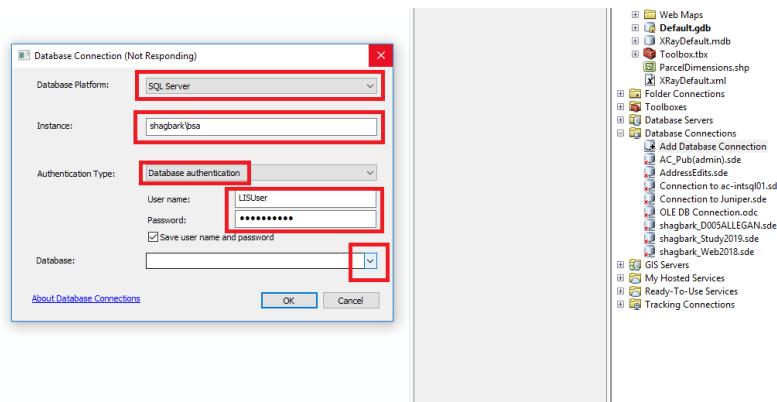


Figure 5.2: Catalog Add Database Connection

### 5.3.2 Create Query in ArcGIS to SQL Database

#### Add Query Layer

##### In ArcMap:

Open the New Query Layer Dialog  
Go to File Add Data Add Query Layer In the connection dropdown select your connection

##### NOTE

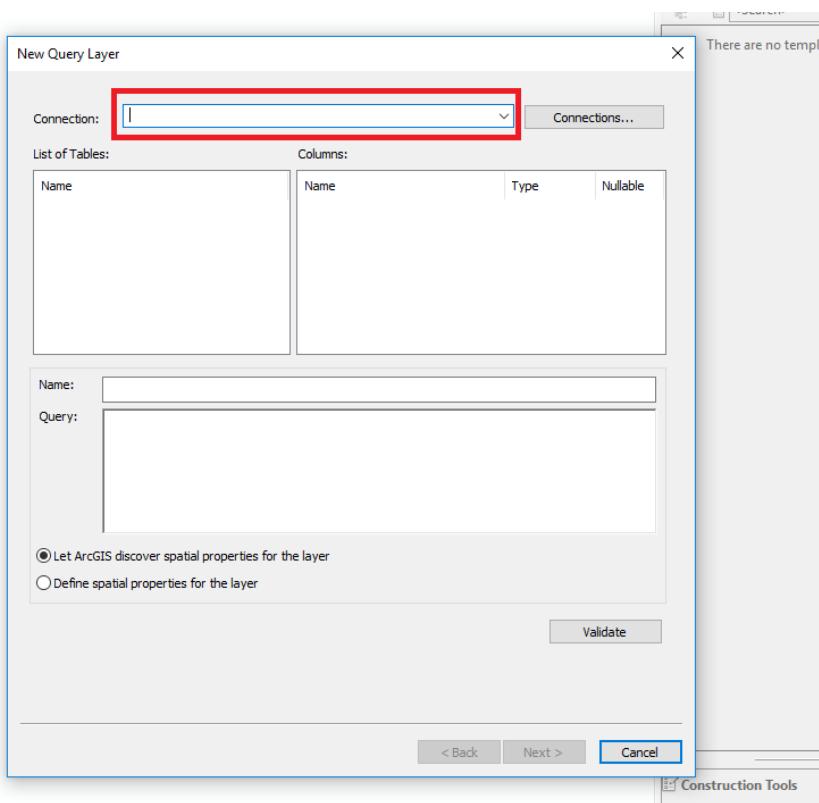


Figure 5.3: New Query Layer Dialog

## Details of the Query Layer

Enter into the tool

- Choose connection
- Name the query
- Enter SQL query
- Press Next

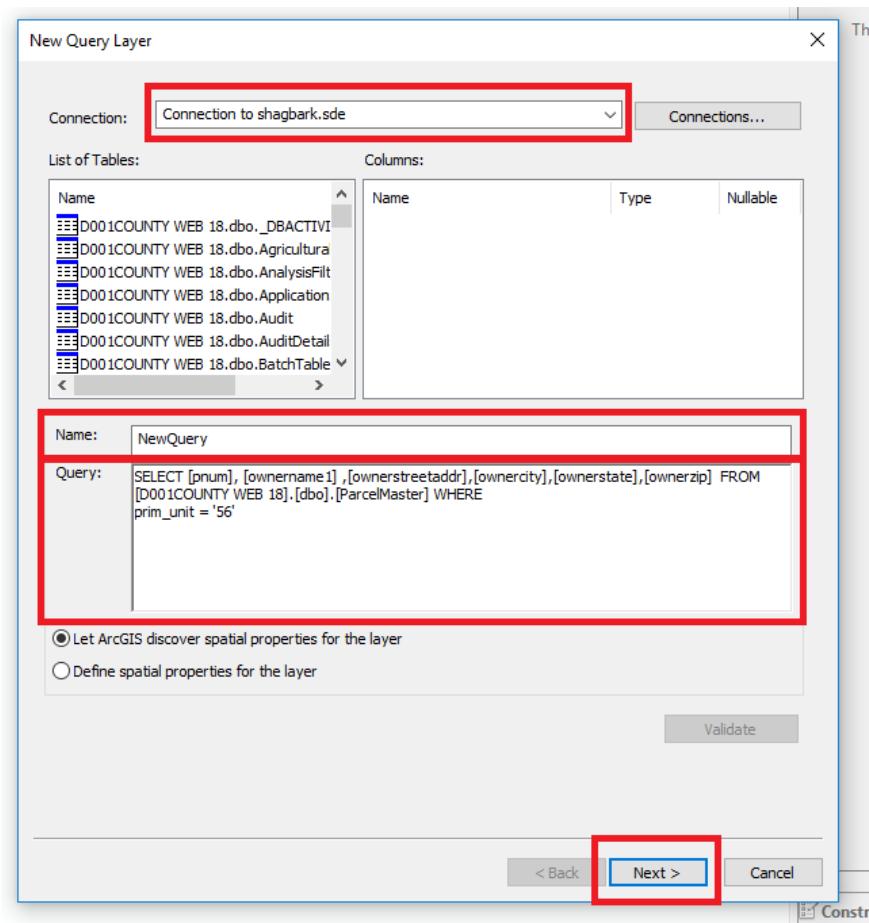


Figure 5.4: Query Layer Dialog Filled

## More Details of the Query Layer

### Enter into the tool

- Select unique identifier field
- Click Finish

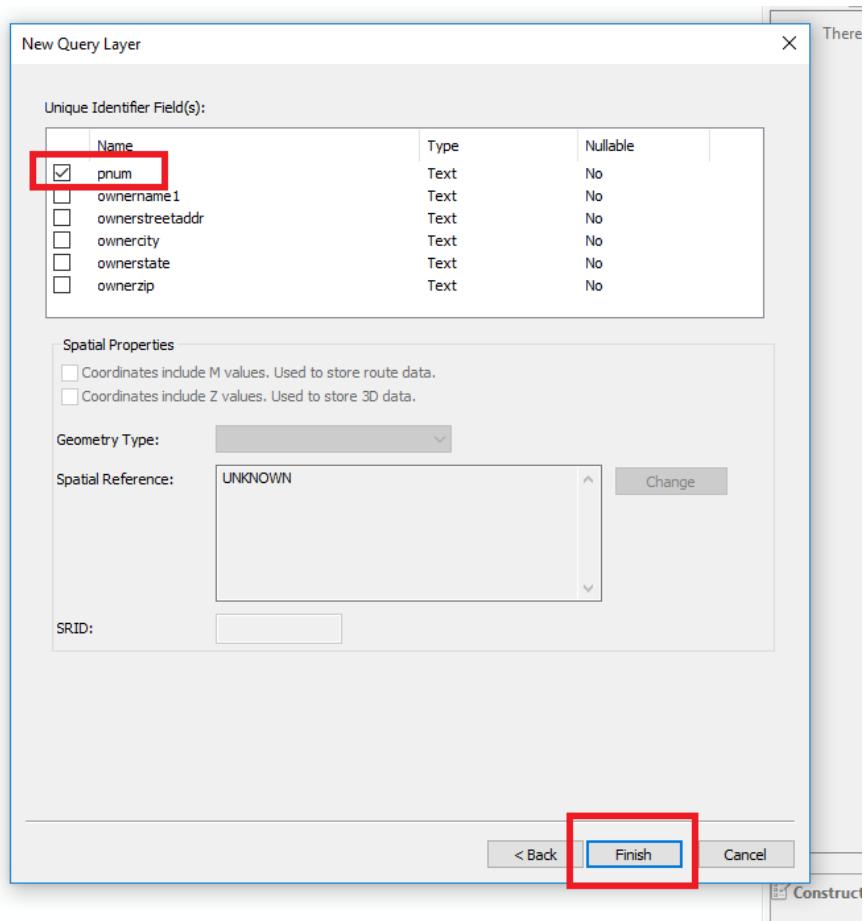


Figure 5.5: Select Unique Identifier

## Open Results Table

The screenshot shows the ArcGIS Pro interface with the 'D001COUNTY WEB 18' table selected in the 'D001COUNTY WEB 18.DBO.NewQuery' feature class. The table has 1666 rows and 9 columns: pnum, ownername1, ownerstreetaddr, ownercity, ownerstate, ownerzip, ESRI\_OID, and two hidden columns. The data includes various property addresses and their owners across different cities and states.

pnum	ownername1	ownerstreetaddr	ownercity	ownerstate	ownerzip	ESRI_OID
56-004-001-00	WAGNER LORINE & ERIN	752 135TH AVE	WAYLAND	MI	49348	1
56-004-001-10	GUN LAKE COMMUNITY CHURCH	12260 WEST M-179	WAYLAND	MI	49348	2
56-004-002-00	WAYLAND UNION SCHOOLS	850 E SUPERIOR ST	WAYLAND	MI	49348	3
56-004-003-00	CITY OF WAYLAND	103 S MAIN ST	WAYLAND	MI	49348	4
56-005-001-00	CITY OF WAYLAND	103 S MAIN ST	WAYLAND	MI	49348	5
56-005-001-00	WAYLAND UNION LLC	1045 W GRAND RIVER DR	LOWELL	MI	49350	6
56-005-002-10	ELLIOTT BAY HEALTHCARE REALTY II	617 EASTLAKE AVE E	SEATTLE	WA	98109	7
56-005-002-20	CITY OF WAYLAND	103 S MAIN ST	WAYLAND	MI	49348	8
56-005-002-30	RIPARIAN PROPERTIES LLC	679 E SUPERIOR ST	WAYLAND	MI	49348	9
56-005-002-40	RIPARIAN PROPERTIES LLC	679 E SUPERIOR ST STE A	WAYLAND	MI	49348	10
56-005-002-50	CITY OF WAYLAND	255 S MAIN ST	WAYLAND	MI	49348	11
56-005-003-00	CITY OF WAYLAND	103 S MAIN ST	WAYLAND	MI	49348	12
56-005-004-00	LATHROP THEODORE W & JUDITH	845 E SUPERIOR ST	WAYLAND	MI	49348	13
56-005-005-00	BREWER SUZANNE M	843 E SUPERIOR ST	WAYLAND	MI	49348	14
56-005-006-00	STEWART MARK R & MELISSA K	841 E SUPERIOR ST	WAYLAND	MI	49348	15
56-005-006-00	DAV DUGLASS JULIE	104 MARLO LN	WAYLAND	MI	49348	16
56-005-006-20	DURAY DOUGLAS	102 MARLO LN	WAYLAND	MI	49348	17
56-005-007-00	CONNOR MOLLY	815 EAST SUPERIOR	WAYLAND	MI	49348	18
56-005-007-10	BENNETT JILL & CARRION BIANCE	2514 BRIDGEPORT LN	GRAND RAPIDS	MI	49508	19
56-005-007-20	LEVENSON KAREN THOMAS	1701 BRIDGEPORT LN	GRAND RAPIDS	MI	49508	20
56-005-007-21	JENSEN KRISTEN S	103 MARLO LN	WAYLAND	MI	49348	21
56-005-008-00	WAYLAND CHRISTIAN REF CHURCH	303 E ULM STREET	WAYLAND	MI	49348	22
56-005-009-00	CITY OF WAYLAND	103 S MAIN ST	WAYLAND	MI	49348	23
56-005-010-00	PRUITT VON V HEALTHCARE PROPERTY LLC	3181 WASHINGTON ROAD	WESTERVILLE	OH	43082	24
56-005-010-00	CITY OF WAYLAND	103 S MAIN ST	WAYLAND	MI	49348	25
56-005-011-00	FERGUSON ROBERT K	6770 VENTURE PARK	KALAMAZOO	MI	49009	26
56-005-012-00	REDSTONE LAND DEVELOPMENT LLC	3330 GRAND RIDGE DR NE	GRAND RAPIDS	MI	49525	27
56-005-012-10	VANDERVOORD JOHN C & NANCY L	542 FOREST ST	WAYLAND	MI	49348	28
56-005-013-00	L LAND M LLC	2845 24TH AVE	HUDSONVILLE	MI	49426	29
56-005-013-00	L LAND M LLC	103 S MAIN ST	SHIPSIDE	MI	49426	30
56-005-014-00	OPPERMAN JOHN C	125 OAK ST	WAYLAND	MI	49348	31
56-005-015-00	REDSTONE LAND DEVELOPMENT LLC	3330 GRAND RIDGE DR NE	GRAND RAPIDS	MI	49525	32
56-005-016-00	WALKER MICHAEL	131 OAK ST	WAYLAND	MI	49348	33
56-005-016-00	WALKER MARK A & MELISSA L	103 S MAIN ST	WAYLAND	MI	49348	34
56-005-016-20	ORTIZ CHRISTINA G & ORTIZ CHRISTINA	119 OAK ST	WAYLAND	MI	49348	35
56-005-019-00	MICHIGAN STATE POLICE #56	544 N MAIN ST	WAYLAND	MI	49348	36
56-005-020-00	WILLIAMS TERESA A	540 N MAIN ST	WAYLAND	MI	49348	37
56-005-021-00	KEMP HOLDINGS LLC	304 108TH ST	CALEDONIA	MI	49316	38
56-005-022-00	SLOAN JOHN L & AMY L	329 WILLOW RUN DR	WAYLAND	MI	49348	39

Figure 5.6: Query Results Table

Verify the Query by Looking at the Table

### 5.3.3 Enterprise Geodatabase Maintenance

#### Enterprise Geodatabase Compression Routine

**Disconnect All Users** Stop the GIS Server to disconnect it. Note

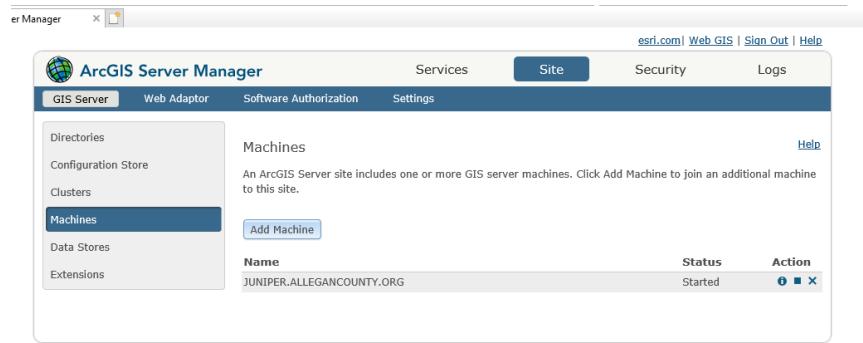


Figure 5.7: Stop ArcGIS Server

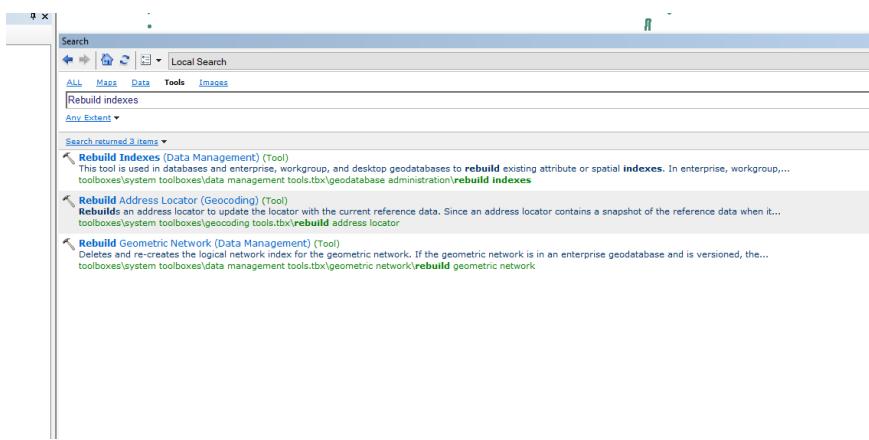
**Note**

Figure 5.8: Find Rebuild Indexes Tool

### Rebuild Indexes Execute the geoprocessing tool Note

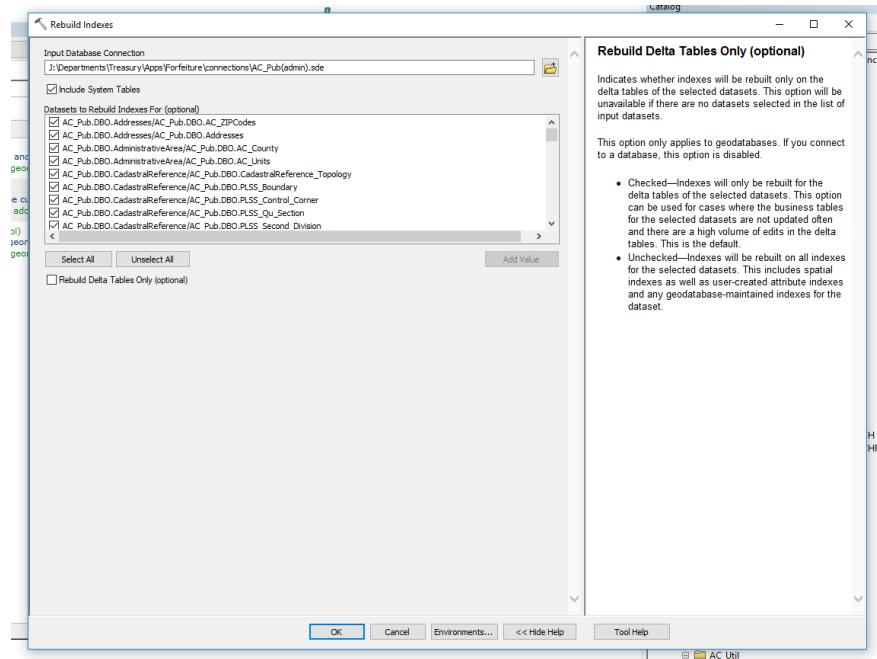


Figure 5.9: Rebuild Indexes Tool Operation

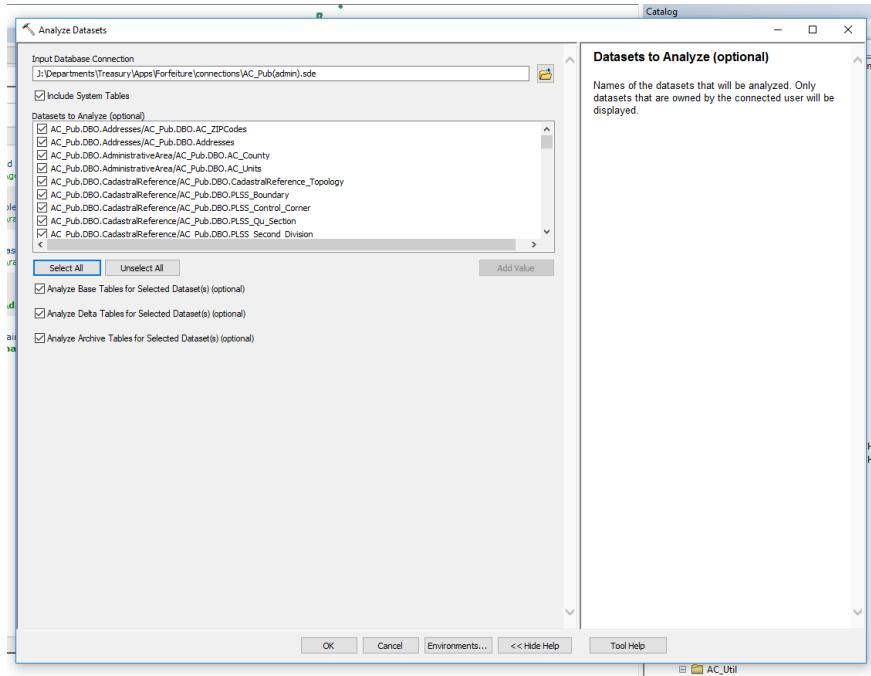
**Recalculate Statistics Note Note**

Figure 5.10: Recalculate Statistics

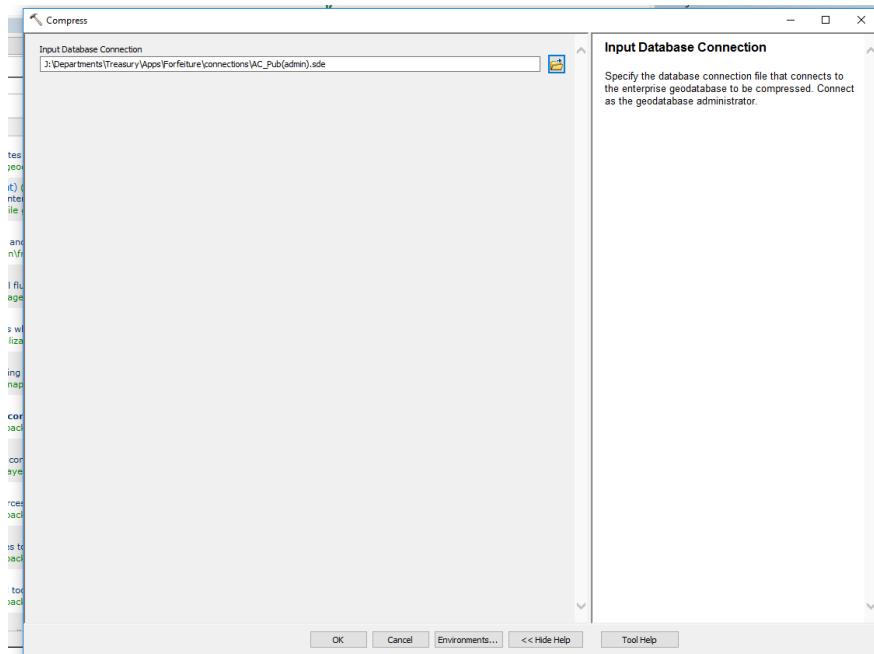


Figure 5.11: Compress

**Compress Note**

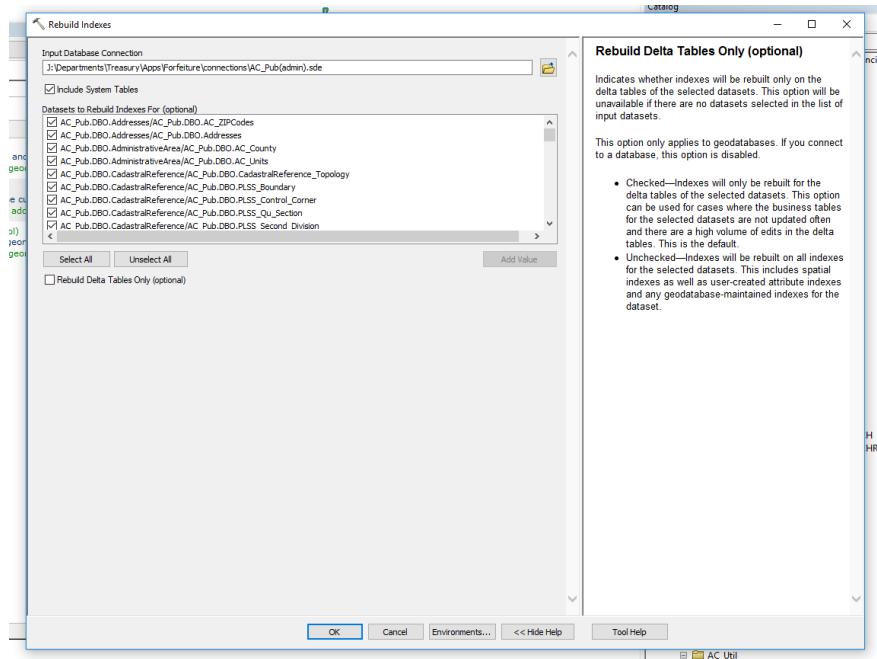
**Rebuild Indexes** Execute the geoprocessing tool Note

Figure 5.12: Rebuild Indexes Tool Operation

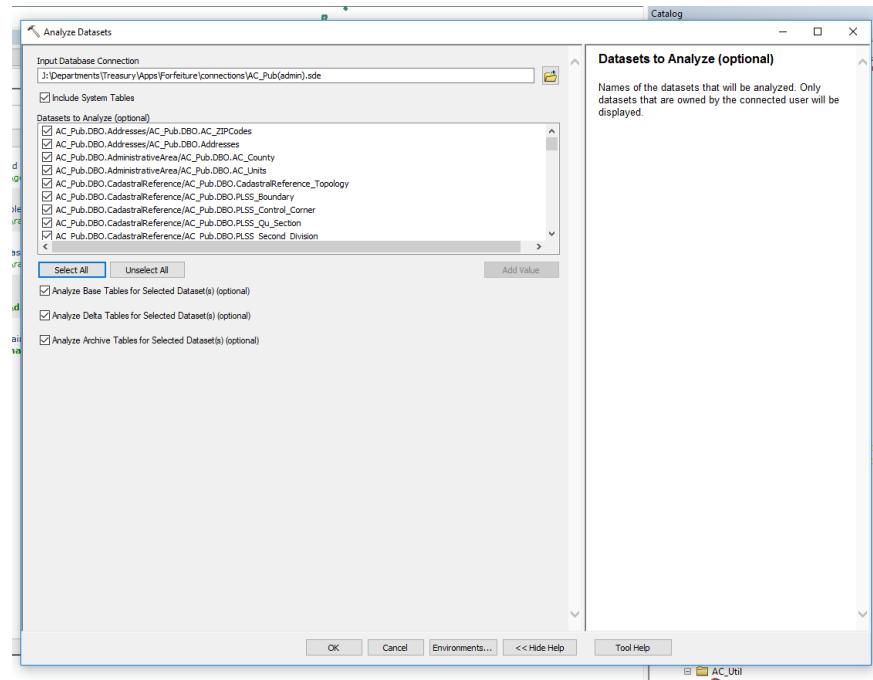
**Recalculate Statistics Note Note**

Figure 5.13: Recalculate Statistics

### 5.3.4 Managing Map Services

#### To stop ArcGIS Server

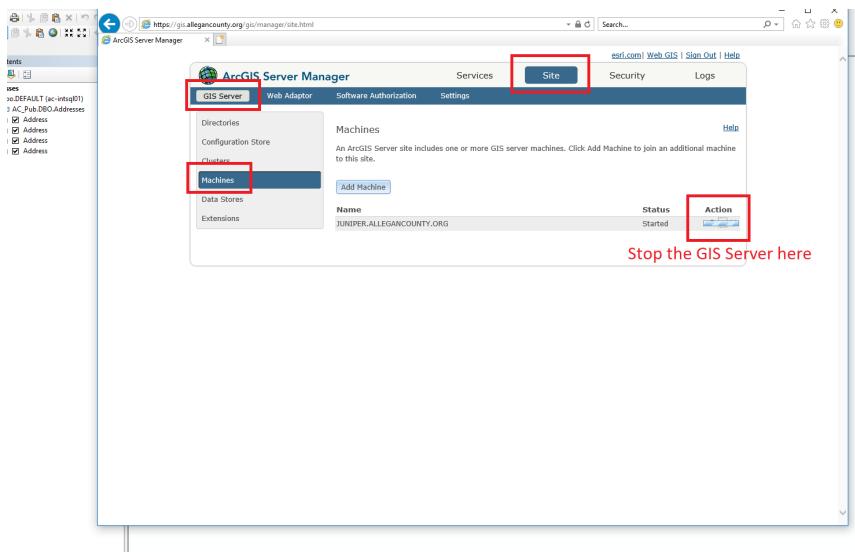


Figure 5.14: Stop the GIS Server

#### Launch ArcGIS Server Manager

### Fixing Damaged Services

#### Removing Lock Files

A blog about it <https://community.esri.com/thread/103710>

```
on juniper
C:\arcgisserver\config-store\services\ParcelViewer2\
PV2Adresses.MapServer\startup\JUNIPER.ALLEGANCOUNTY.ORG
```

This method works.

Steps:

- 1)stop arcgis server services.
- 2)delete the lock files(\*.glock and \*.rlock )
   
in arcgisserver\config-store.
- 3) restart arcgis server service.

4)stop the pending stopping service and then start it.

### 5.3.5 Managing Geodatabase Replicas

#### Adding A New Feature Class To A Replica

Source: <https://support.esri.com/en/technical-article/000010345>

##### Summary

Currently, there is no out-of-the-box tool to add a feature class to an existing replica. With ArcGIS Desktop, one must either recreate the replica or if the workflow allows, replicate the new feature class as a separate replica.

A feature class or table can only be added to an existing replica (without recreating the replica) using ArcObjects code.

##### Steps:

The steps below outline how to recreate the replica using the Register Existing Data option in Desktop. These steps can be applied to both one-way and two-way replicas.

Synchronize the changes between parent and child replica geodatabases using the existing replica so that the data is identical in each database, then Unregister the replica in both geodatabases. For two-way replicas, ensure that changes are synchronized in both directions and there are no outstanding edits before unregistering the replica. Create/import the new feature class into the parent geodatabase, and add the GlobalID. Register the newly added data as versioned. Copy and paste the new feature class to the child geodatabase using ArcCatalog. Note: that the GlobalIDs must have already been added to the feature class.

For two-way replica or one-way full model, register the newly added data in child geodatabase as versioned. Using the parent geodatabase, add all the data that is to be replicated to a map in ArcMap. Click the 'Create Replica' tool on the Distributed Geodatabase toolbar. Select 'One way replica' or 'Two way replica' and click Next. Select 'Register existing data only'. Select the child geodatabase and specify a replica name. Click Next and click Finish. A new replica is created that includes the new data.

### 5.3.6 Managing Geodatabase Versions

#### Version Queries

##### SQL Queries

Four queries of SDEversions, SDEstates, sdestatelineages, and SDEcompress-log

```
use AC_Pub
select name, owner, version_id, state_id, parent_name
, parent_owner from
[AC_Pub].[dbo].[SDE_versions]
select * from [AC_Pub].[dbo].[SDE_states] order by state_id
select * from [AC_Pub].[dbo].[sde_state_lineages] order
by lineage_name,
lineage_id
select TOP(5) * from [AC_Pub].[dbo].[SDE_compress_log] order by
compress_end DESC
```

Query of SDEversions and SDEstates

```
use AC_Pub
SELECT v.version_id,v.creation_time,v.creation_time,
s.state_id, s.creation_time
FROM SDE_versions v
INNER JOIN SDE_states s ON v.state_id = s.state_id
```

## Finding Orphaned Versions

### ID and delete orphaned geodatabase versions

Follow the procedure: [Link to source](#)

Use SQL Server Management Studio to execute two queries and compare the results.

#### Step 1:

Execute the query:

```
use AC_Pub
SELECT ObjectID, name from dbo.GDB_ITEMS where
TYPE='4ED4A58E-621F-4043-95ED-850FBA45FCBC';
```

#### Step 2:

Execute the query:

```
use AC_Pub
SELECT name from [dbo].[SDE_versions]
order by name
```

Compare the tables

This graphic summarizes elements of the queries. Note the items from step

The screenshot shows two SQL queries in SSMS:

- Query 1 (Left):** `use AC\_Pub; SELECT ObjectID, name from dbo.GDB\_ITEMS where TYPE='4ED4A58E-621F-4043-95ED-850FBA45FCBC';` A red box highlights the WHERE clause.
- Query 2 (Right):** `use AC\_Pub; SELECT name from [dbo].[SDE\_versions] order by name`

Below the queries are two result sets:

- Results for Query 1 (Left):** A table with columns ObjectID and name. It lists several replicas:
 

ObjectID	name
16497	ProtoPub.ParcelPubReplica
16520	ProtoPub.LandUsePlanningReplica
17074	SchoolsReplica
17542	ElReplica
17893	EmergencyMgmt
19929	AddressesReplica
40149	EnvHealthReplica

 A green arrow labeled "Matches" points from the first six rows to the second table. A red arrow labeled "No Matches" points to the last row (40149).
- Results for Query 2 (Right):** A table with column name. It lists several version names:
 

name
C:\address\temp\versionPar
DEFAULT
3_MtnTreasToReversionParc
4_SYNC_SEND 17893 0
5_SYNC_SEND 40959 12
6_SYNC_SEND 40965 7

 A blue arrow labeled "replica ID" points to the first row. A purple arrow labeled "generation #" points to the last row.

Figure 5.15: Find Orphan Versions

two that have no match in step one.

Orphaned versions can be removed by name in ArcGIS

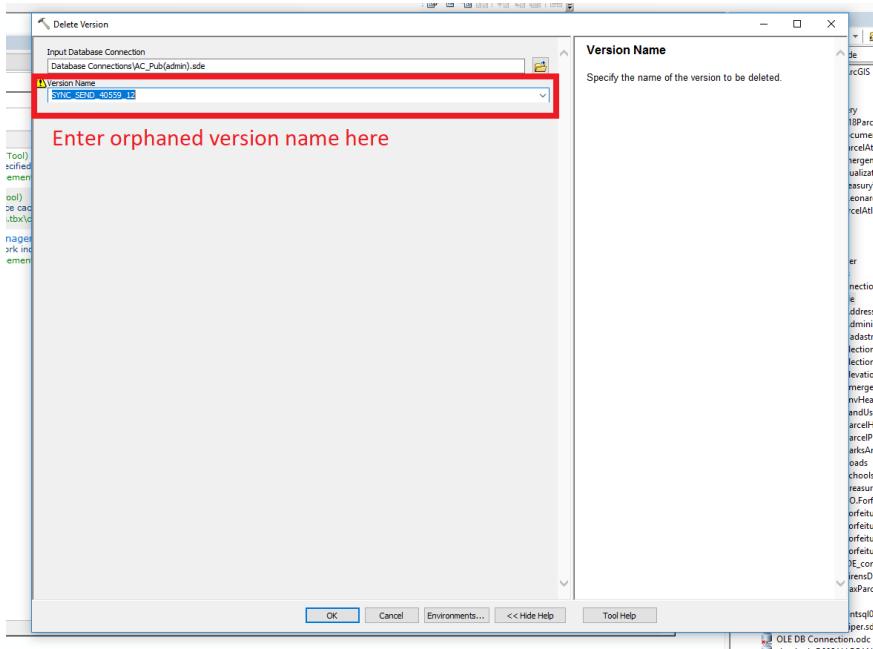


Figure 5.16: Delete Orphan Versions

### 5.3.7 MXD Management

#### Find/Replace Text Object

##### Python Code

Python Code for finding and replacing a text object in a ArcGIS .mxd file. A snippet of this code may be found in the LayerUpdates/Zoning/processing folder. It is used to edit the .mxd files located there.

```
import arcpy
from arcpy import env

env.workspace = r"J:\Apps\Python\LayerUpdates\zoning\processing"
for mxdname in arcpy.ListFiles("*.mxd"):
    print mxdname
    mxd = arcpy.mapping.MapDocument(r"J:\Apps\Python\LayerUpdates\zoning\processing\" + mxdname)
    for elm in arcpy.mapping.ListLayoutElements(mxd, "TEXT_ELEMENT"):
        if elm.text.startswith('As ammended'):
            elm.text = elm.text.replace('As ammended', 'As amended')
            print elm.text
    mxd.save()
del mxd
```

## 5.4 L<sup>A</sup>T<sub>E</sub>X Packages used by AC GIS

### 5.4.1 float Package

#### usepackage

text

#### Simple Use

text

#### Options

text

Add optional arguments to the usepackage line:

Useful options:

- **OPTION NAME**  
OPTION NOTE
- **OPTION NAME**  
OPTION NOTE

#### Use with options

text

#### Commands

### 5.4.2 Graphics Examples and Notes

## CurlyFrame Example

```
\documentclass[landscape]{article}
\usepackage{wallpaper}
\usepackage{niceframe}
\usepackage{xcolor}
\usepackage{ulem}
\usepackage{graphicx}
\usepackage{geometry}
\geometry{tmargin=.75cm,bmargin=.25cm,lmargin=.8cm,rmargin=.2cm}
\usepackage{multicol}

\begin{document}

\curlyframe[.9\columnwidth]{

TEXTTTTTTTTTTTTTTTT

}

\end{document}
```

## RectFrame Example

```
\documentclass[landscape]{article}
\usepackage{wallpaper}
\usepackage{niceframe}
\usepackage{xcolor}
\usepackage{ulem}
\usepackage{graphicx}
\usepackage{geometry}
\geometry{tmargin=.75cm,bmargin=.25cm,lmargin=.8cm,rmargin=.2cm}
\usepackage{multicol}

\begin{document}
\begin{minipage}{.33\textwidth}
\centering
\scalebox{3}{\color{green!30!black!60}
\font\border=umrandb
\generalframe
{\border \char113} % up left
{\border \char109} % up
{\border \char112} % up right

```

```
{\border \char108} % left  
{\border \char110} % right  
{\border \char114} % lower left  
{\border \char111} % bottom  
{\border \char115} % lower right  
\centering  
\includegraphics[height=1.25cm]{GIS_Logo_better.jpg}}}  
\end{minipage}  
\vspace{-8mm}  
  
\end{document}
```

### 5.4.3 graphicx Package

#### usepackage

text

#### Simple Use

text

#### Options

text

Add optional arguments to the usepackage line:

Useful options:

- **OPTION NAME**  
OPTION NOTE
- **OPTION NAME**  
OPTION NOTE

#### Use with options

text

#### Commands

### 5.4.4 hyperref Package

#### Introduction

Official hyperref package documentation

Notes:

- Add the *hyperref package* to the preamble **last** [2]
- To use Tex in a pdf bookmark: use

\texorpdfstring{\\"{}{}}

ie. \paragraph{Sample Text\texorpdfstring{\\"{}{}}}

Creates a new line without an error.

\usepackage[options]{hyperref}

## Simple Use

Use `\href{URL}{DESCRIPTION}` to add a link with description

`\href{https://www.latex-tutorial.com}{Website with tutorials}`  
produces:

Website with tutorials

## Options

Add optional arguments to the `usepackage` line:

Useful options:

- **pdftex**

enables other options like breaklines

- **breaklinks**

allow links to be broken across several lines

eg. <https://lists.gnu.org/archive/html/emacs-orgmode/2013-06/msg00776.html>

- **colorlinks**

Colors the text of links and anchors.(default is false)

- **linkcolor**

Color for normal internal links(default is red).

- **anchorcolor**

Color for anchor text.

- **citecolor**

Color for bibliographic citations in text.

- **urlcolor**

Color for linked URLs

## Use with options

```
\usepackage[breaklinks,colorlinks,citecolor=blue,
urlcolor=green]{hyperref}
```

## Commands

`\href{URL}{text}` Makes text a link to URL.

To put a file path in text:

eg:

[Official hyperref package documentation](#)

(documentation Pt.4 pg.15)

\href [options]{URL}{text}

Options:

- absolute

```
\href{C:/AC/jalapeno/documentation/packageDocs/hyperref2017.pdf}
    {Official hyperref doc}
```

- relative **Note: relative path must be from final pdf location**

```
\href{../../../../documentation/packageDocs/hyperref2017.pdf}
    {Official hyperref package doc}
```

\*This path works from main document

```
\href{../../../documentation/packageDocs/hyperref2017.pdf}
    {Official hyperref package documentation}
```

\*This path works from subsection document

\hyperref [label]{text}

Makes text a link to where \ref{label} would point.

\hypertarget{name}{text}

Sets an anchor on text with the label name.

\hyperlink{name}{text}

Makes text a link that takes you to the anchor labeled name.

\*Pair with \hypertarget.

\phantomsection

Used in conjunction with

\addcontentsline

to make the correct link in the Table of Contents.

### 5.4.5 import Package

#### usepackage

text

#### Simple Use

text

#### Options

text

Add optional arguments to the usepackage line:

Useful options:

- **OPTION NAME**  
OPTION NOTE
- **OPTION NAME**  
OPTION NOTE

#### Use with options

text

#### Commands

## 5.4.6 standalone Package

### Introduction

[Link to official standalone documentation](#)

*standalone* provides a **package** and a **class**

- The *standalone package* is used for:

- Main documents that will input or import sub documents.
- For example:

```
\usepackage[subpreambles=false]{standalone}
```

\* Ignores preambles of imported sub documents [3, pg.4]

- the *standalone class*:

- Is a document class
- Provides standalone / subdocument switches and options
- For example:

```
\documentclass[class=article]{standalone}
```

\* behaves as an article when standalone  
 \* makes document available for import into a master document

### Simple Use

- The *standalone package*

- In the main document:

```
\documentclass[openany]{book}
```

```
\preamble...
```

```
\usepackage{standalone}
```

- the *standalone class*:

- In any subdocument:

```
\documentclass[class=article]{standalone}
```

```
\preamble...
```

## Options

- The *standalone* package
  - **subpreamble**
    - \* default value of subpreambles is *false*
- the *standalone* class:
  - **crop**
  - **titlepage**
  - **twoside**
    - \* Makes pagination style match book
    - \* default value is *false*
  - **multi**
    - \* `multi=true|false`
    - \* `multi={<environment name>, ...}`
  - **float**

## Use with options

- the *standalone* package:
  - `\usepackage[subpreambles=false]{standalone}`
- the *standalone* class:
  - `\documentclass[class=article , crop=false, titlepage, twoside, multi={itemize, figure, verbatim}, float=false]{standalone}`

## Commands

### 5.4.7 wrapfig Package

#### usepackage

text

#### Simple Use

text

#### Options

text

Add optional arguments to the usepackage line:

Useful options:

- **OPTION NAME**  
OPTION NOTE
- **OPTION NAME**  
OPTION NOTE

#### Use with options

text

#### Commands

## 5.5 LATEX Templates

### 5.5.1 LATEX Section Template

```
%\documentclass[class=report , crop=false, multi={itemize, figure}, float=false]{standalone}%Exp
\documentclass[class=book , crop=false]{standalone}

\input{../../../../../preamble}

\def\titlename{Section Template}

\title{\input{../../../../commonTitle}} % closing brace for title

\begin{document}% Document Begins

\input{../../../../commonFront} % provides standalone options

\section{SECTION NAME HERE}

\subimport{RELATIVE PATH TO NEW Section/}{NEW SUBSECTION Subsection.tex}

%eg.
%\subimport{latexTemplatesSection/}{subsectionTemplateSubsection.tex}
% etc...

\end{document}
```

### 5.5.2 LATEX Subsection Template

```
\documentclass[class=book , crop=false]{standalone}

\input{../../../../../preamble}

\def\titlename{Subsection Template}

\title{\input{../../../../commonTitle}} % closing brace for title

\begin{document}% Document Begins

\input{../../../../commonFront} % provides standalone options

% NEW INFO GOs HERE.
\subsection{Subsection Template}
```

\medskip

## **5.6 PDF Tools used by AC GIS**

### 5.6.1 Introduction

**Purpose and Summary** **Workflow Purpose:** Optimization of a large number of pdf docs.

**Workflow Summary:** Uses Python to create a list of .pdf docs in a folder and creates a batch file to optimize the pdfs in the list to another location. The batch process calls ghost script for the optimization.

**requirements** Opensource software:

- ghostscript
- python 2.7 and a Python IDE
- A text editor

### 5.6.2 Python(2.7)

**Note:** The output of this script is bdoc.txt, Save as a .bat to execute the optimize.

**Script that creates a batch file**

```
import os, sys

project = os.path.dirname(os.path.dirname(__file__))
processing = os.path.join(project, 'processing')
#source = os.path.join(project, 'source')
build = os.path.join(project, 'build')
sourcepdf = os.path.join(build, '20180716')

inString1 = "gswin32 -sDEVICE=pdfwrite -dCompatibilityLevel=1.4
-dPDFSETTINGS=/ebook -dNOPAUSE -dQUIET -dBATCH
-sOutputFile=J:\\\\Projects\\\\2018ParcelAtlas\\\\build\\\\optimized\\\\"

inString2 = " J:\\\\Projects\\\\2018ParcelAtlas\\\\build\\\\20180716\\\\"

batchdoc = os.path.join(processing, "bDoc.txt")

# Main
#####
if __name__ == "__main__":
    list1 = os.listdir(sourcepdf)
    l = open(batchdoc, 'w')
    for i in list1:
```

```
newi = i[1:]
print newi
t = inString1 + newi + inString2 + i + "\n"
print t
l.write(t)

l.close()
```

### 5.6.3 ghostscript

**About** ghostscript is used for the optimization. ghostscript is an interpreter for the PostScript language and for PDF [1].

**Licensing** ghostscript is available opensource under AGPL conditions. more information can be found [here](#).

**Download** ghostscript can be downloladed [here](#).

### 5.6.4 Windows batch files

A line from the batch file looks like:

```
gswin32 -sDEVICE=pdfwrite -dCompatibilityLevel=1.4
-dPDFSETTINGS=/ebook -dNOPAUSE -dQUIET -dBATCH
-sOutputFile=J:\Project\2018ParcelAtlas\build\optimized\
02-001-001-00.pdf J:\Projects\2018ParcelAtlas\build\20180716
\_02-001-001-00.pdf
```

## 5.7 QGIS Tools

### 5.7.1 Using COGO Tools in QGIS

**Set up the Azimuth and Distance Plugin (Azd Plugin).**

In the Plugins drop down(1), under the topography group select the **Azd Plugin(2)**(see fig.).

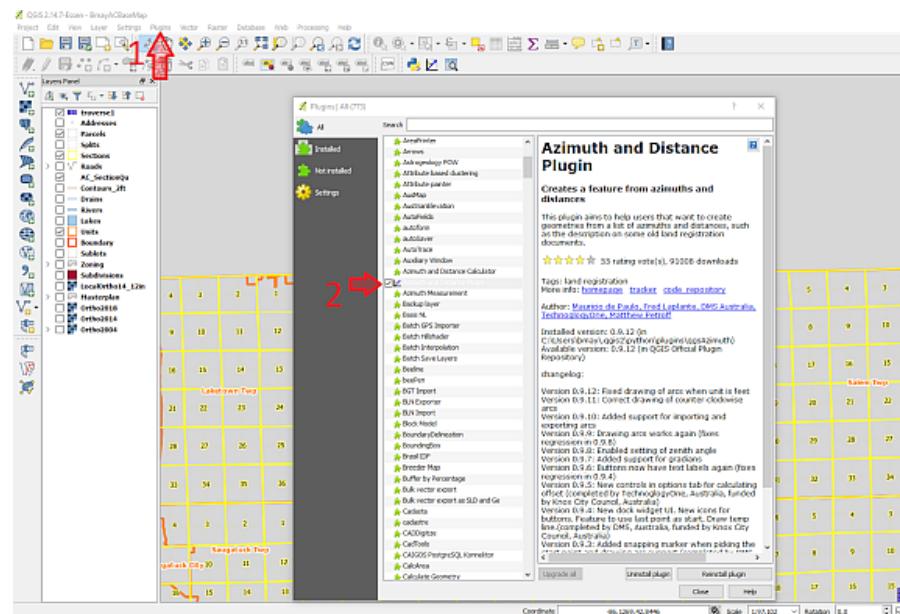


Figure 5.17: launch plugin

Note here which layer is active (see fig.).

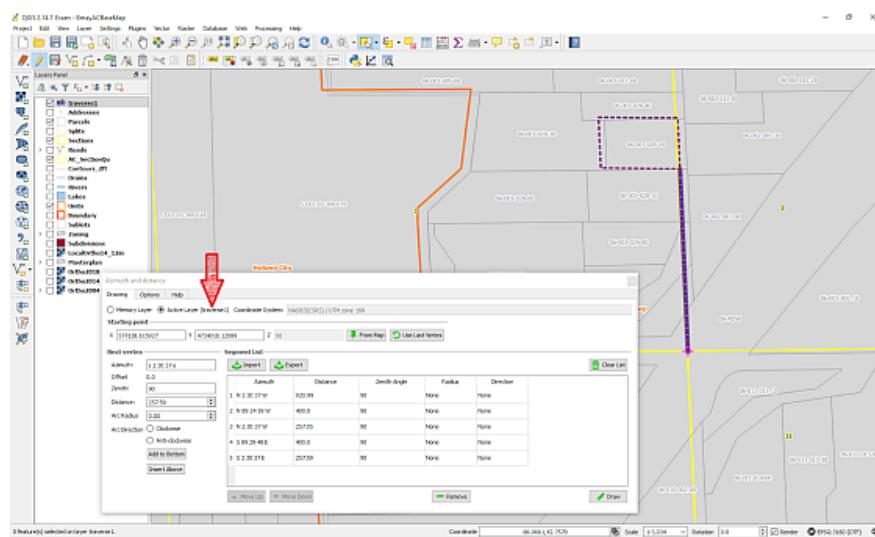


Figure 5.18: check active layer

If necessary, left click the layer ***traverse 1*** in Layer Panel to activate it(see fig.).

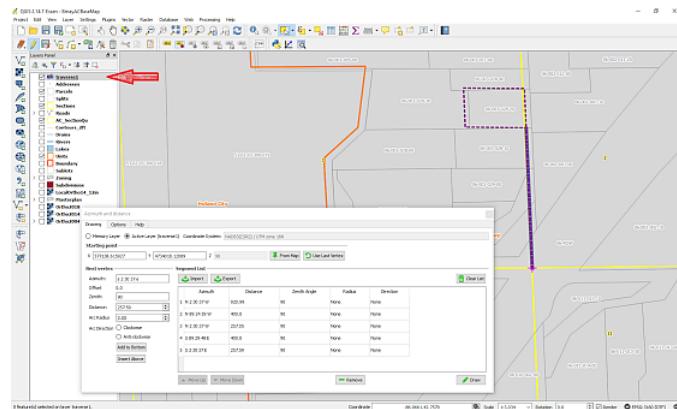


Figure 5.19: activate layer

**Configure Options** On Options Tab: Select Boundary, Bearing, Feet, and Degree radio buttons.

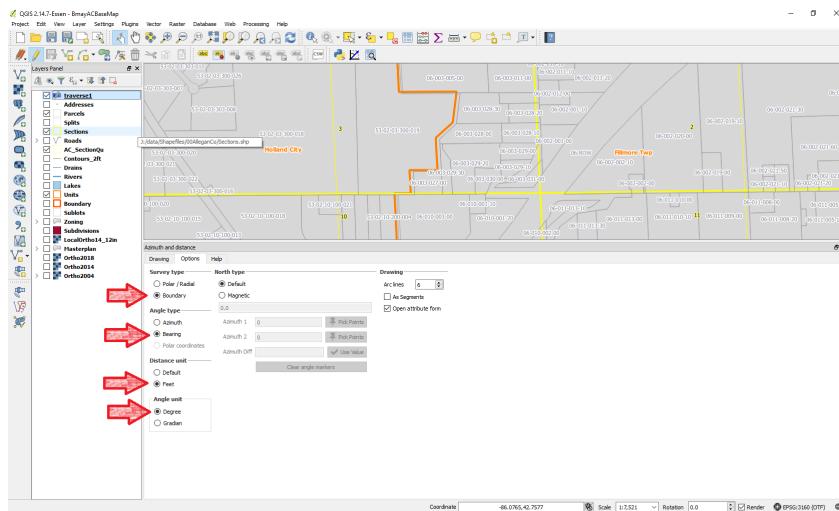


Figure 5.20: Plugin Options

**Using the tool** Boundary descriptions are entered into the Drawing Tab. Azimuth (bearing) and Distance are the important boxes (Set Offset = 0 and Zenith = 90 and ignore)(see below).

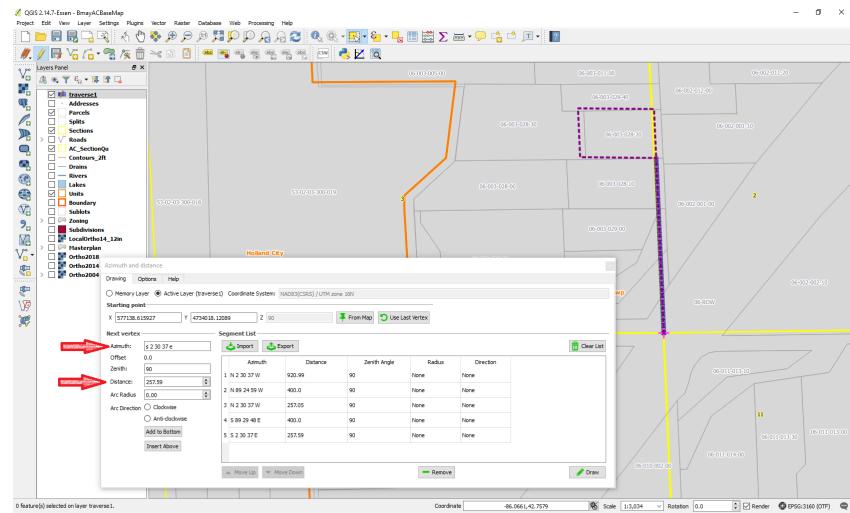


Figure 5.21: Entering Bounds

### Configure editing environment

Use Settings Dropdown and Snapping Options to enable snapping to Sections, Quarter Sections, and or Parcels if desired (see fig.).

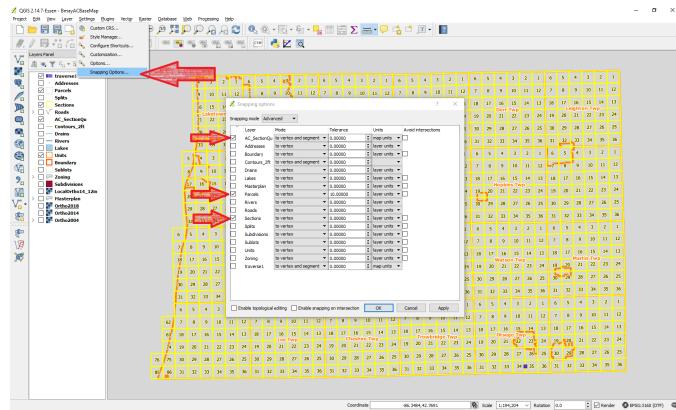


Figure 5.22: Configure editing environment

## **Locate Point of Commencement**

To get to the Point of Commencement,

Use **any combination** of the following methods:

- Using Reference Layer
- Using Measuring Tool
- Search by Parcel Number (Search Layers Plugin)
- Draw COGO lines (Azd Plugin)(as described earlier)

**Using Reference Layer** Use reference layers; Units, AC\_SectionsQu, Sections, and Parcels. Toggle layers on and off in Layers Panel and zoom in and out with mouse wheel.

**Using Measuring Tool** Use the measuring tool, make sure to set units to feet. To exit current measurement right click (see fig.).

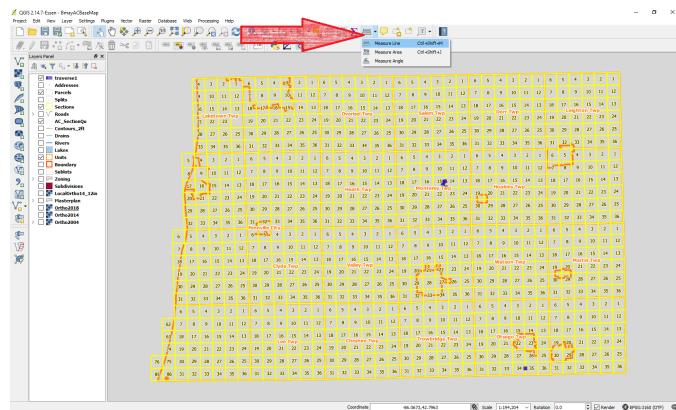


Figure 5.23: Measuring Tool

### Search by Parcel Number (Search Layers Plugin.)

To Launch Search Layers Plugin:  
 In Plugins dropdown:  
 Enable the **Search Layers** Plugin. (see fig.)

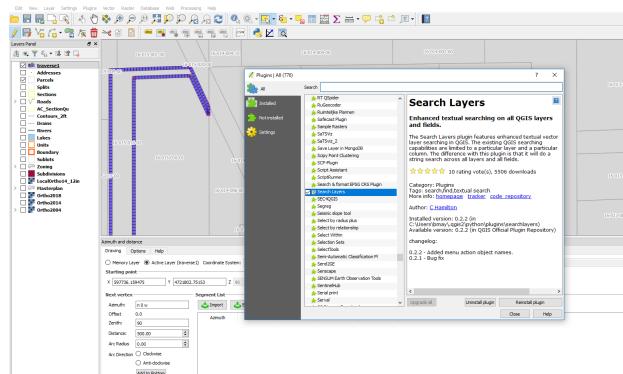


Figure 5.24: Search Layers Plugin

Enter parcel number (with dashes), Set layers, and set search field.(see fig.)

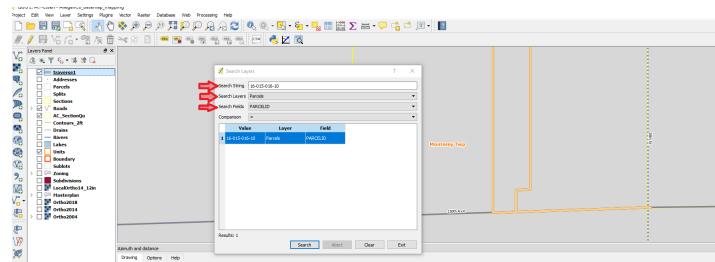


Figure 5.25: Search Layers Setup

# **Part IV**

# **Resources**

# Appendices

## A.1 Geography 101

Foundations of geography

### A.1.1 A Primer on Coordinate Systems Commonly Used in Michigan

[A Primer on Coordinate Systems Commonly Used in Michigan](#)

## B.2 ESRI Resources

Product Documentation

### B.2.1 Functionality Matrices

arcgis 10.5 Enterprise Functionality Matrix [Document](#) [Link](#)  
arcmap 10.5 Functionality Matrix [Document](#) [Link](#)

# Bibliography

- [1] Artiflex, *ghostscript.com*, 2018. 89
- [2] na, *The hyperref package*, CTAN, na ed., na na. 78
- [3] Martin Scharrer, *The standalone package*, CTAN, 1.3a ed., 03 2018. 82

# Glossary

**IDE** Integrated Development Environment. 80

**map projection** Representing a sphere on a flat surface. 11, 80

**sample** an example. 80

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