

GIS Final Project
Determining Regions of Anthropogenic Recharge

Objective

A grid for the recharge zone of the Barton Springs segment of the Edwards Aquifer within the city limits of Austin, TX was generated by Pierce (2006). This grid was utilized in Modflow to model recharge in both natural and human-influenced conditions. Pierce (2006) originally determined the amounts of impervious cover within each cell of the grid in order to correct recharge values by designating these zones as regions of no recharge. Since this study, Wiles (2007) has determined that areas with impervious cover contribute recharge from secondary permeability. Additionally, a previous study, (Garcia-Fresca, 2004), has identified other sources of recharge within urbanized areas that have not been traditionally considered. These sources include leakage from water utility lines, waste water lines, and stormwater ponds.

The objective of this study is to determine the area covered by impervious cover, stormwater ponds, water supply lines, and waste water lines within each cell of the grid produced in Pierce (2006). Each feature has an associated recharge rate that will be utilized in Modflow to determine the overall recharge rate of each cell. A GIS will be utilized to divide each anthropogenic recharge feature into its corresponding cell based on its geographic location. After features are divided into separate cells, the total area covered by each feature within any cell can be calculated.

Data Collection

The grid shapefile was supplied by Dr. Suzanne Pierce from the Center for International Energy and Environmental Policy, Jackson School of Geosciences, The University of Texas at Austin. The shapefiles for stormwater ponds, land uses for Austin (2006), water utility lines, and waste water lines were supplied by the City of Austin. The files supplied by the City of Austin can be downloaded online at:

ftp://ftp.ci.austin.tx.us/GIS-Data/Regional/coa_gis.html. The following is a table summarizing the data obtained for this study.

Name	Shapefile Type	Projected Coordinate System	Source
Land Use (2006)	Polygon	NAD_1983_StatePlane_Texas_Central_FIPS_4203_Feet	City of Austin
Commercial Ponds	Polygon	NAD_1983_StatePlane_Texas_Central_FIPS_4203_Feet	City of Austin
Residential Ponds	Polygon	NAD_1983_StatePlane_Texas_Central_FIPS_4203_Feet	City of Austin
Modflow Grid	Polygon	NAD_1983_Albers	Pierce (2006)
Water Lines	Line	NAD_1983_StatePlane_Texas_Central_FIPS_4203_Feet	City of Austin
Waste Water Lines	Line	NAD_1983_StatePlane_Texas_Central_FIPS_4203_Feet	City of Austin

Data Preprocessing

No preprocessing was required.

Data Processing

1. Defining Projections: converted the Modflow Grid to NAD 1983, StatePlane Texas Central FIPS 4203 Feet.
 - ArcToolbox – Data Management Tools – Projections and Transformation – Define Projection
2. Create Personal Geodatabase: imported multiple feature classes into a Personal Geodatabase in order to more easily manage files
 - Open ArcCatalog – Right Click on desired folder – New – Personal Geodatabase
 - Right Click on newly created Personal Geodatabase – Import – Feature Class (multiple) – Select desired shapefiles
3. Clip Files to Modflow Grid: clip all shapefiles to the Modflow grid in order to get rid of data outside of the region of interest. Also helps reduce the size of the files which allows greater ease of processing
 - ArcToolbox – Analysis Tools – Extract – Clip (Input Features = shapefiles to be clipped, Clip Features = grid)
4. Edit Pond Files: delete Flood Detention ponds from both the Commercial and Residential pond clipped shapefiles. These ponds are not considered for this study and do not need to be included. After the

Flood Detention ponds are removed, the remaining ponds are grouped into three categories: Wet Ponds, Retention/Irrigation, Sedimentation/Filtration

- Editor drop down arrow – Start Editing – Target: Commercial or Residential pond shapefile – Open Attribute Table – Options drop down arrow – Select by Attributes – Input Formula: [POND_TYPE] = 'Flood Detention' – Right Click on selected – Delete Selected – Save Edits – Stop Editing

5. Join Clipped Land Use Shapefile and Table: the land use file was not originally joined to its look up table that identified what land use types corresponded to land use codes. After the file was joined to the lookup table, land use types could be defined.

- Right Click on the land use shapefile in the TOC – Joins and Relates – Join – Select appropriate fields the join will be based on and the table the join will be based upon

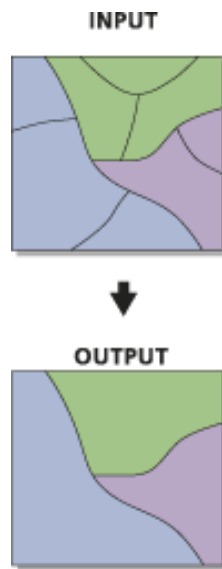
6. Divide clipped shapefiles based on corresponding grid cells utilizing the “Identity” tool: This step will make new shapefiles from the clipped shapefiles; their new shapes will be based upon their original outlines and where they intersect the Modflow grids. The main goal of this step was to create new shapefiles that contained information about which Modflow grid cell it was within. *Computes a geometric intersection of the Input Features and Identity Features. The Input Features or portions thereof that overlap Identity Features will get the attributes of those Identity Features* (ArcGIS help).



- ArcToolbox – Analysis Tools – Identity – Input Features: Desired Shapefile to be divided,

Identity Features: Modflow Grid, XY Tolerance: 1 foot

7. Combine similar recharge features from the “Identity” analysis into a single shapefile utilizing the “Dissolve” tool: The attributes used to combine recharge features were Type (pond type or land use type) and Grid Cell ID. Once this was done, new shapfiles were created by combining previous shapefiles together based on these two attributes. *Aggregates features based on specified attributes.* (ArcGIS Help).



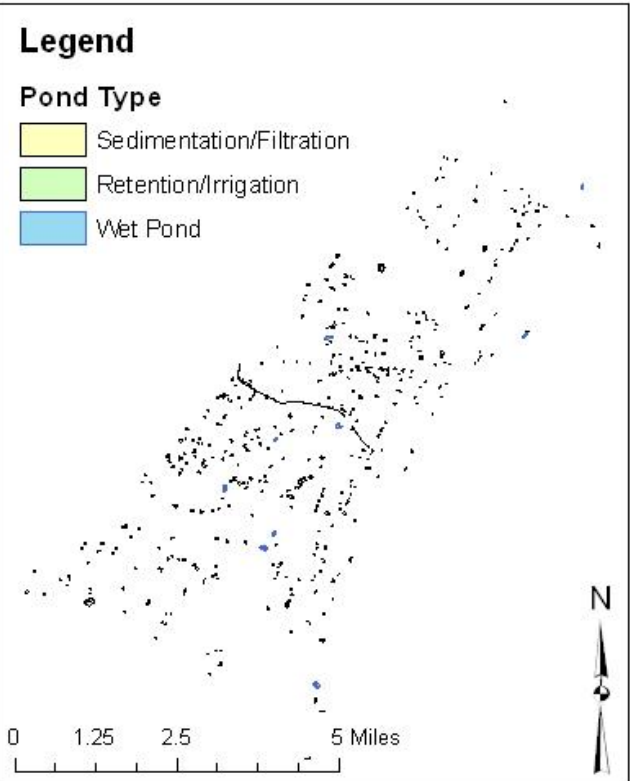
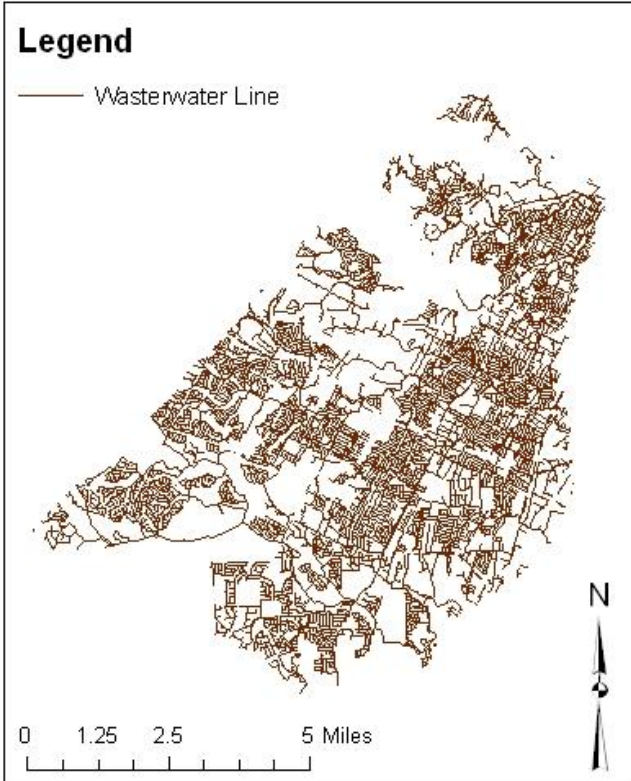
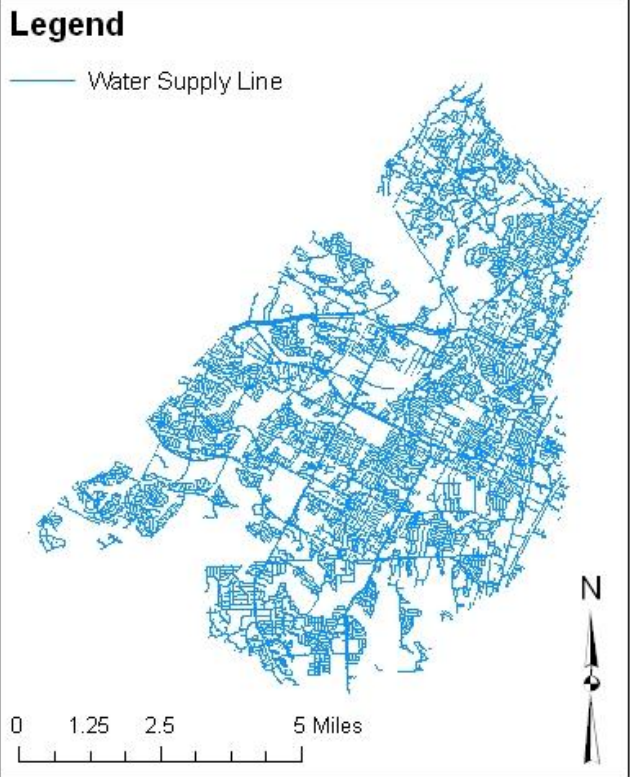
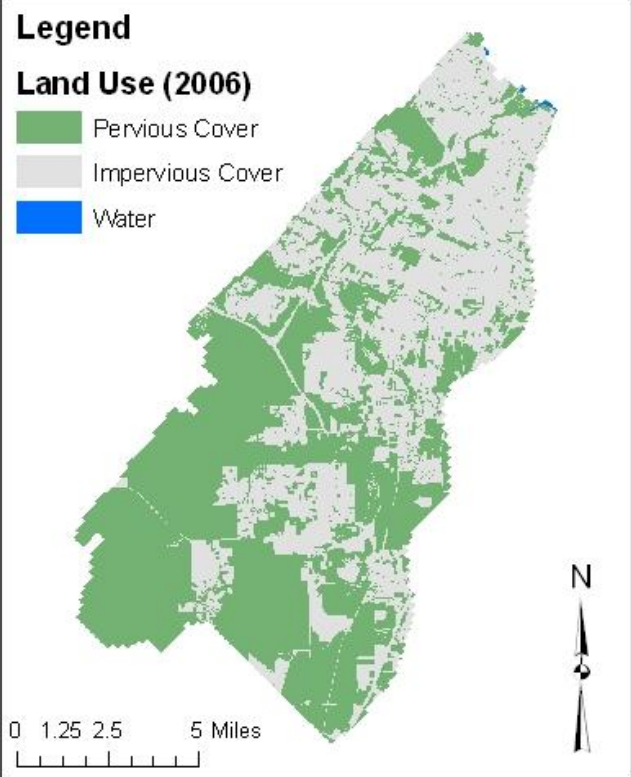
- ArcToolbox – Data Management Tools – Generalization – Dissolve – Input Features: Shapefiles from the “Identity” Analysis, Dissolve Fields: Pond/Land Use Type and Modflow Grid Cell ID

8. Symbolize dissolved shapefiles accordingly and generate map

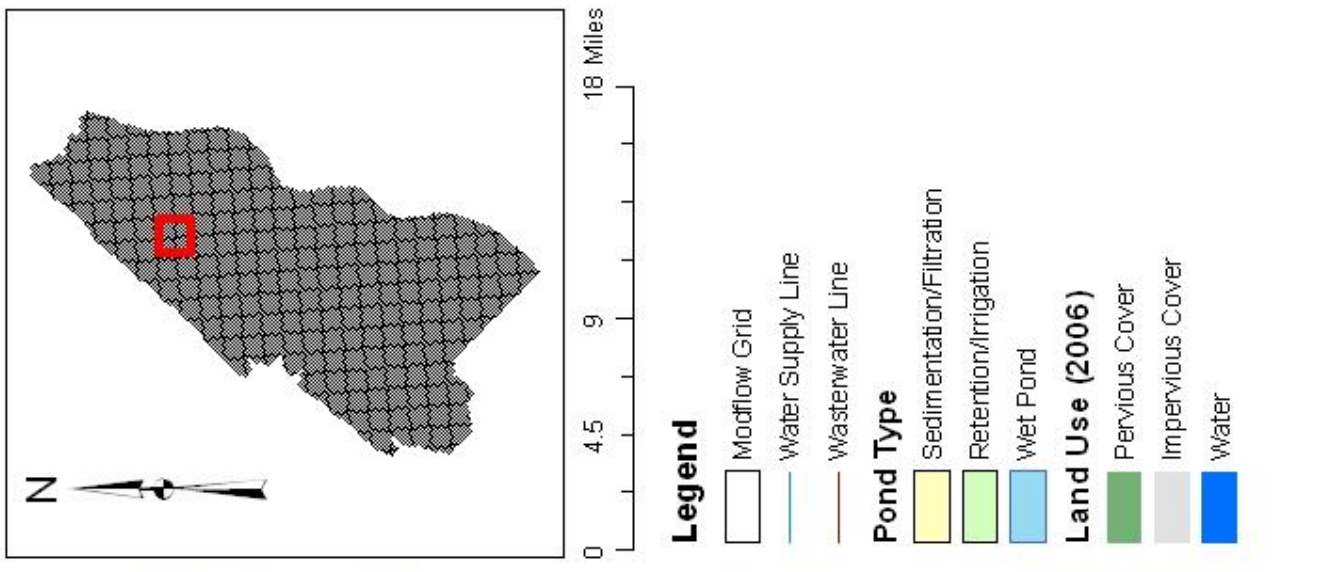
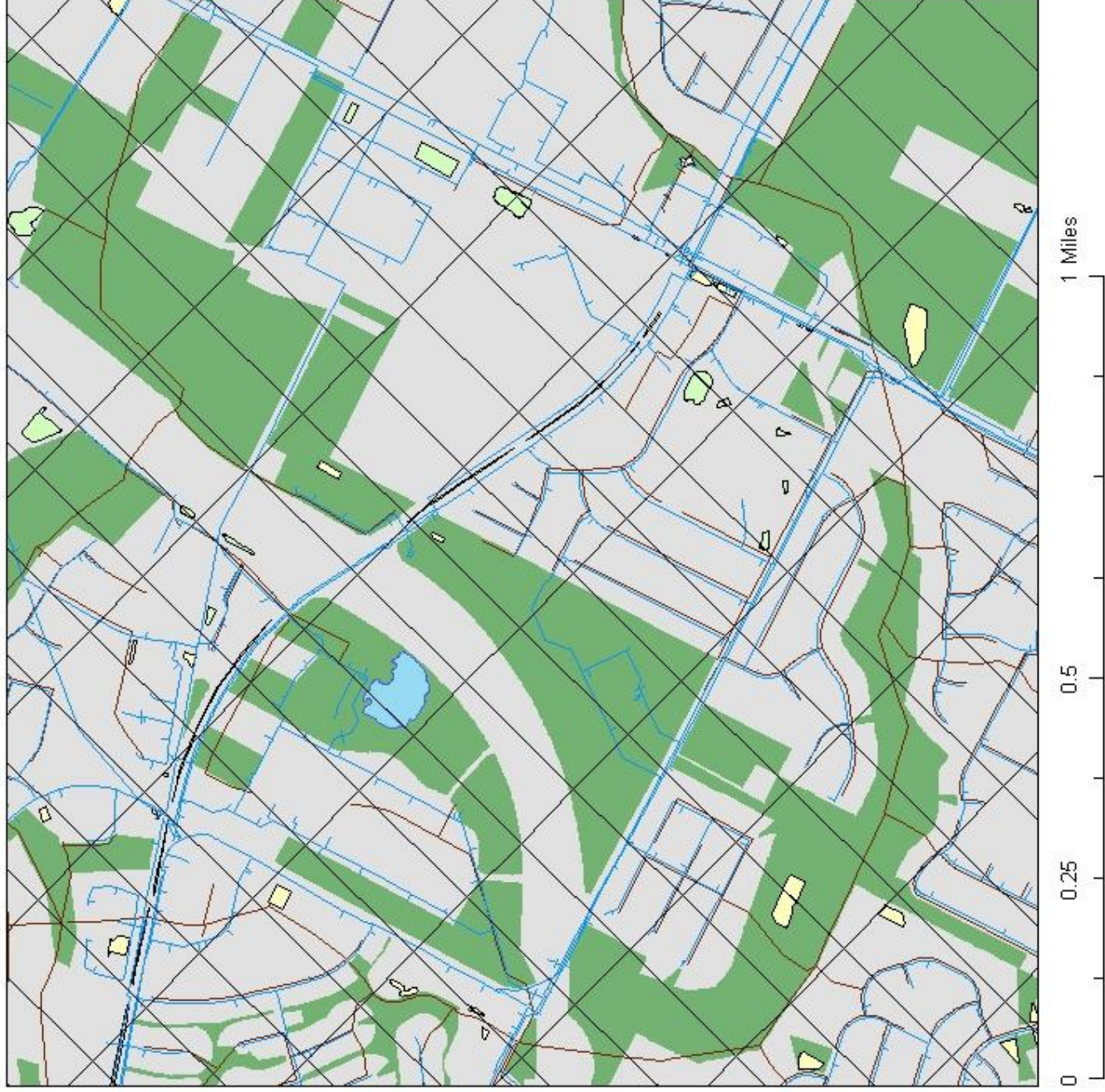
Results

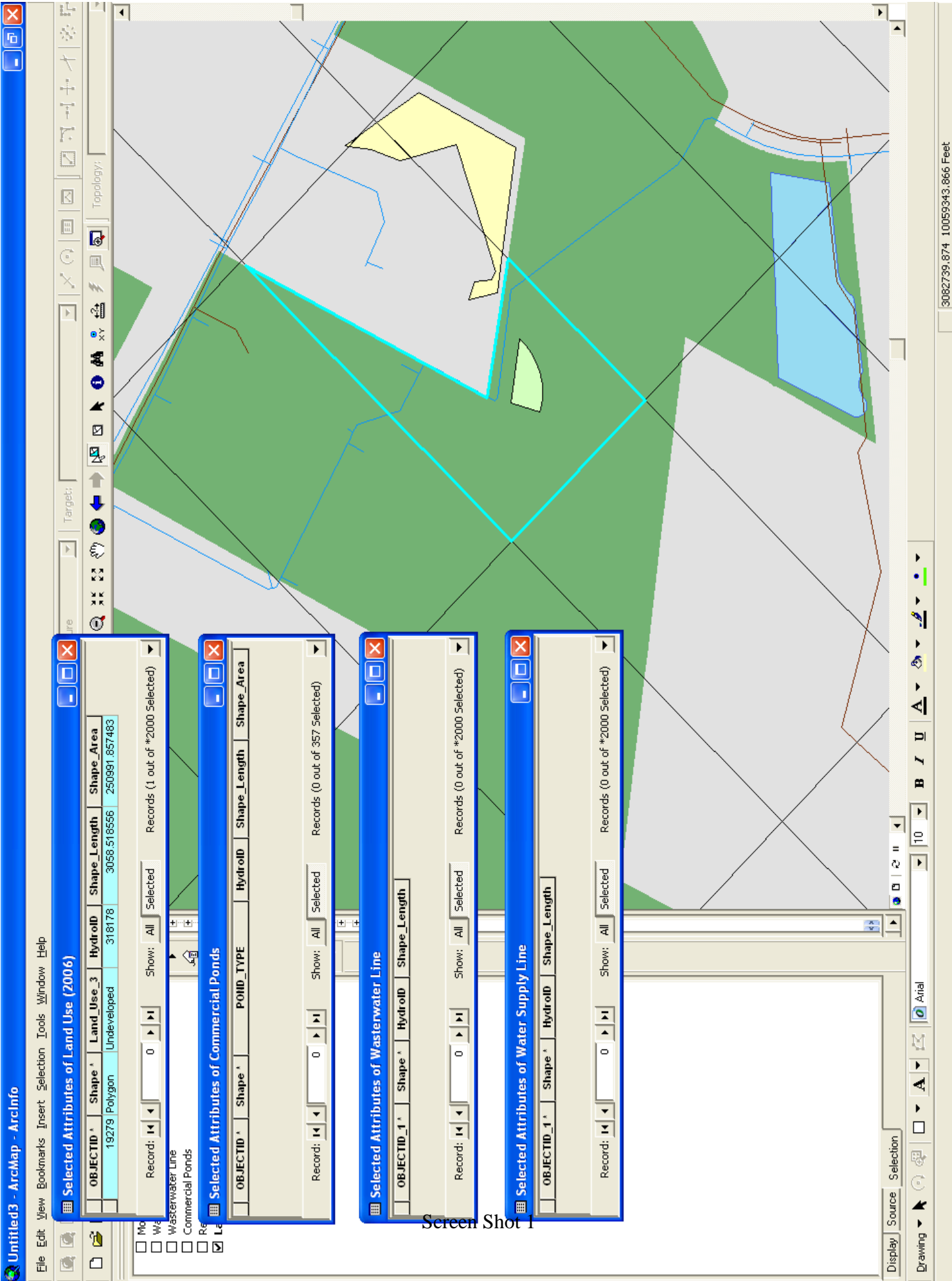
The end product of this project allows for easy calculation of area and length of each recharge feature within each Modflow grid cell. There are over 3000 grid cells; thus, no manageable table was created to summarize the data for all cells. Instead, a map was created for a random region within the grid to represent what the map would look like zoomed in to an area of interest. There is also a map displaying the full extent of each data set (recharge features) within the grid. Lastly, one cell was selected to highlight the new shapes files generated through the above processes. Five screen shots were taken to highlight these different recharge features being highlighted with its corresponding attribute table.

Entire Data Set For Each Respective Anthropogenic Recharge Feature

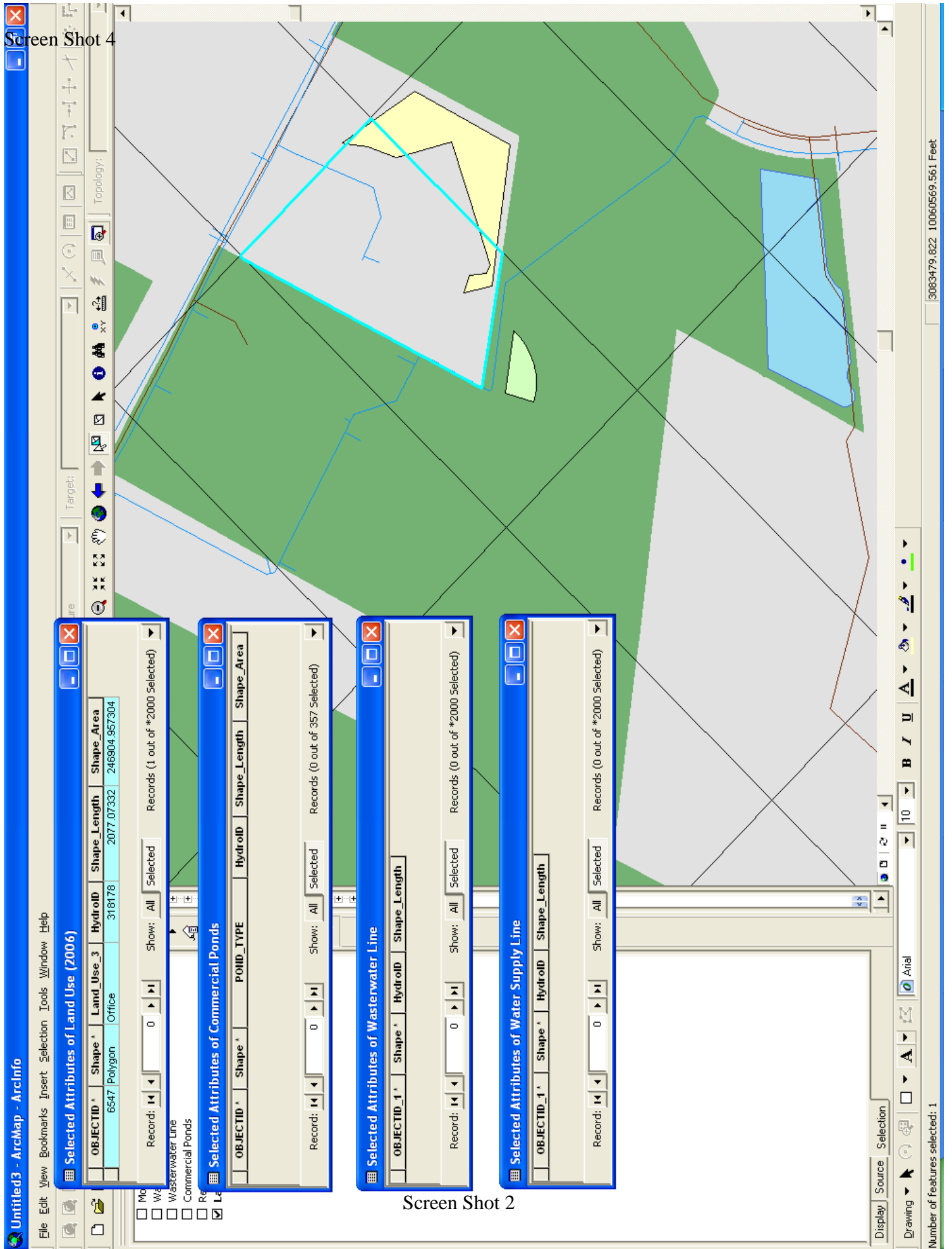


Spatial Distribution of Anthropogenic Recharge Features within a Modflow Grid Recharge Zone of the Barton Springs Segment of the Edwards Aquifer, Austin, TX



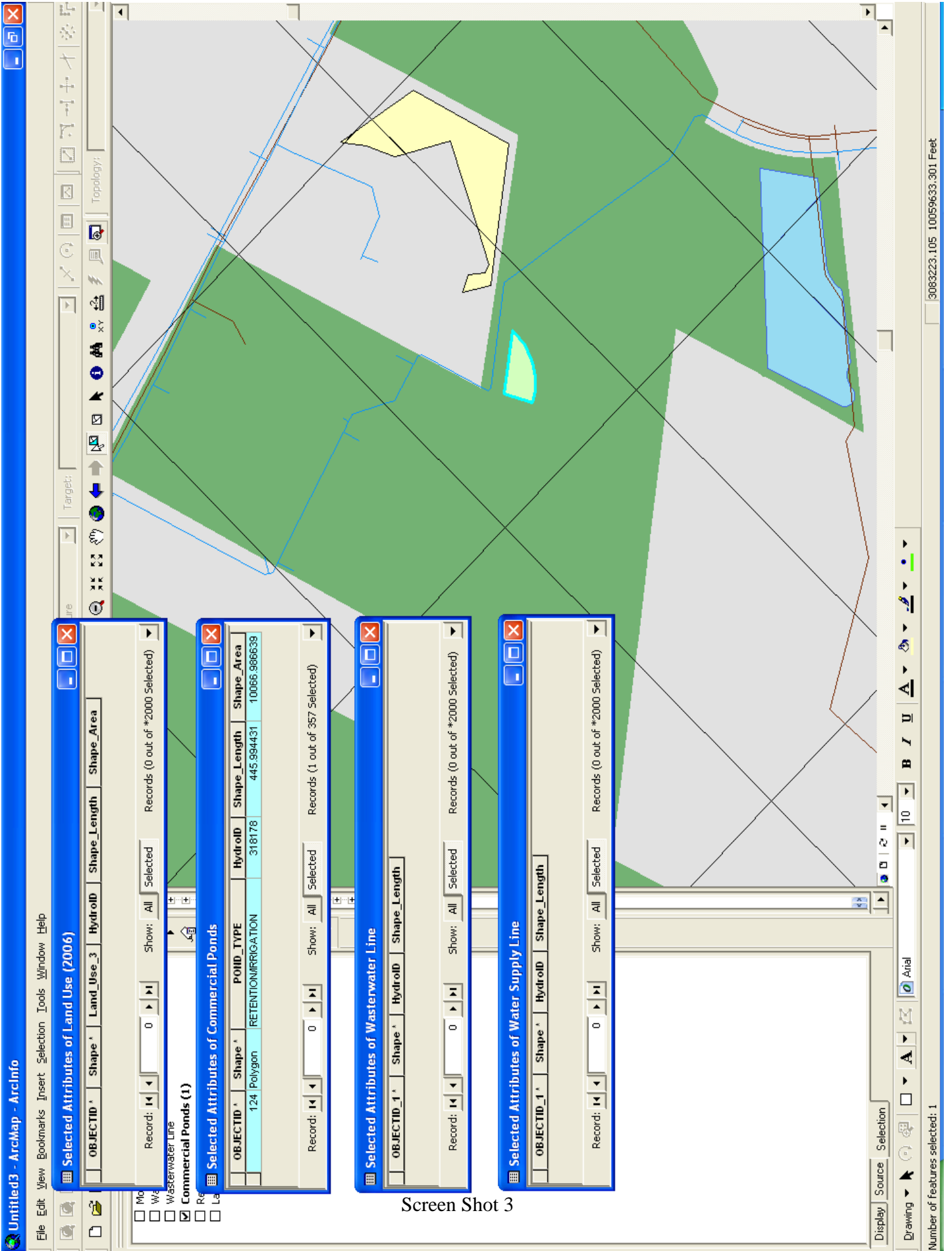


Screen Shot 1



Screen Shot 4

Screen Shot 2



Selected Attributes of Land Use (2006)

OBJECTID	Shape	Land_Use_3	Hydroid	Shape_Length	Shape_Area
Record: 0	0	All	Selected	Records (0 out of *2000 Selected)	

Selected Attributes of Commercial Ponds

OBJECTID	Shape	POID_TYPE	Hydroid	Shape_Length	Shape_Area
124	Polygon	RETENTION/IRRIGATION	318178	445.994431	10066.986639
Record: 0	0	All	Selected	Records (1 out of 357 Selected)	

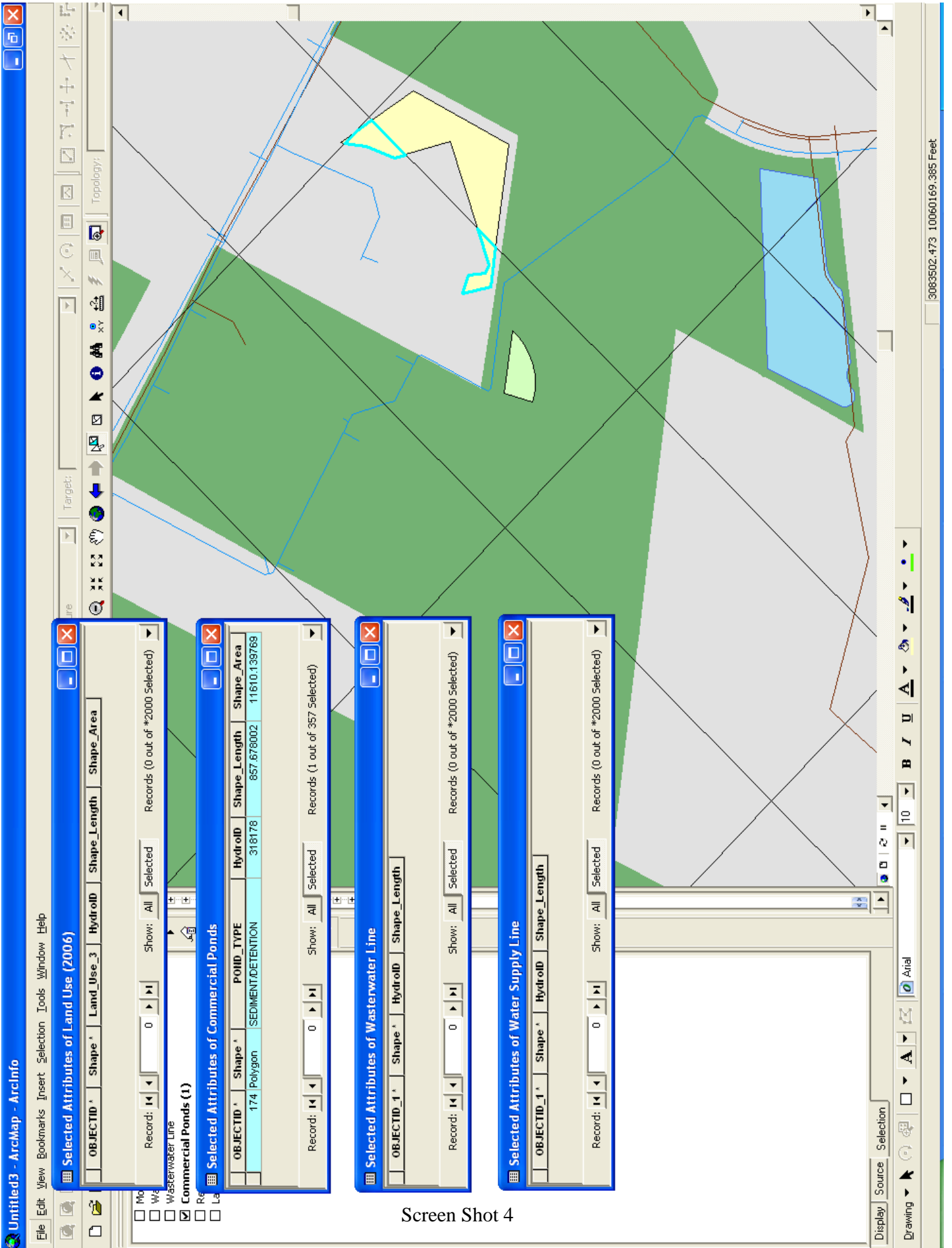
Selected Attributes of Wastewater Line

OBJECTID_1	Shape	Hydroid	Shape_Length	
Record: 0	0	All	Selected	Records (0 out of *2000 Selected)

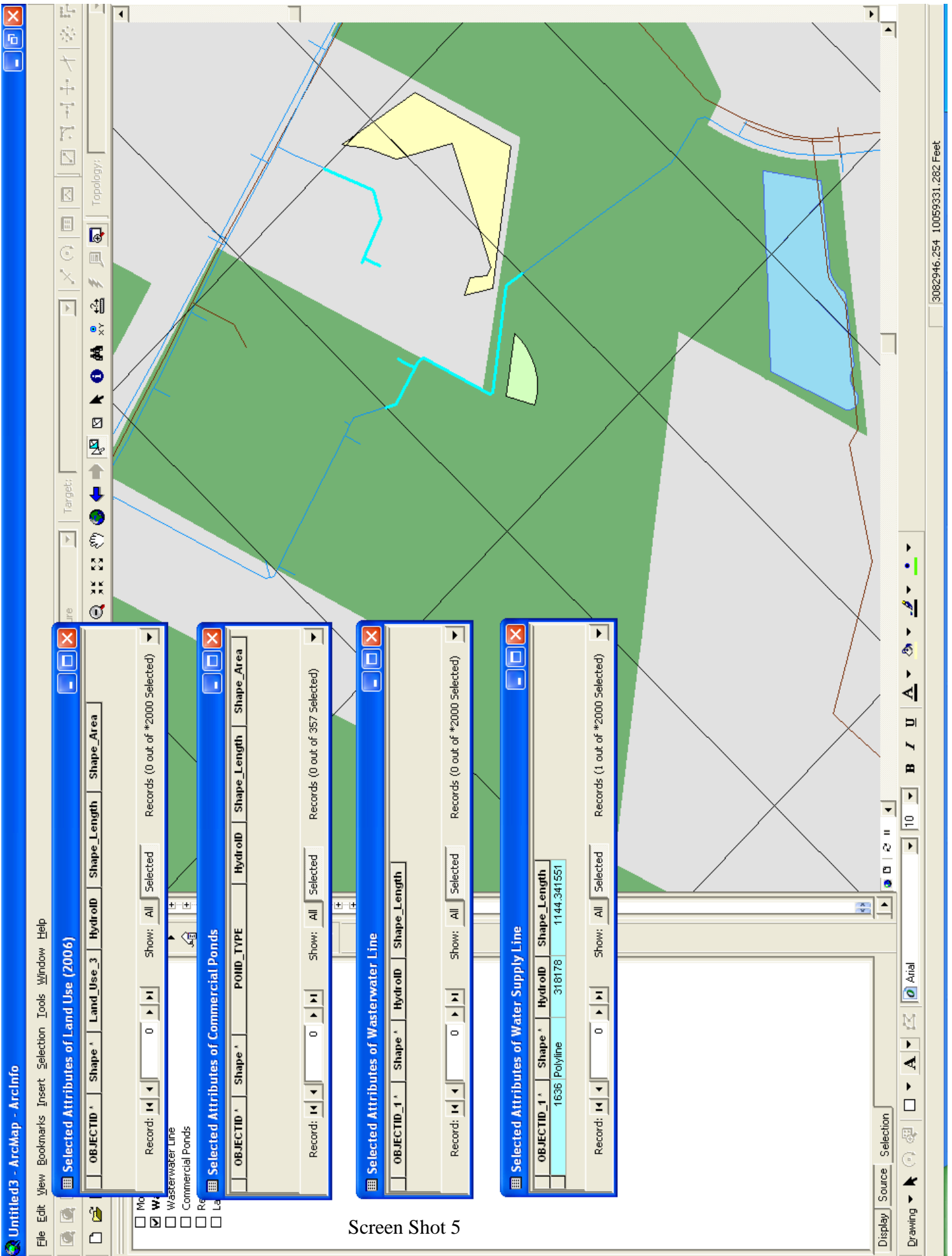
Selected Attributes of Water Supply Line

OBJECTID_1	Shape	Hydroid	Shape_Length	
Record: 0	0	All	Selected	Records (0 out of *2000 Selected)

Screen Shot 3



Screen Shot 4



Screen Shot 5