# ESTIMATION OF SURFACE RUNOFF AREA EFFECTED BY RIPARIAN BUFFERS IN THE ILLINOIS RIVER WATERSHED

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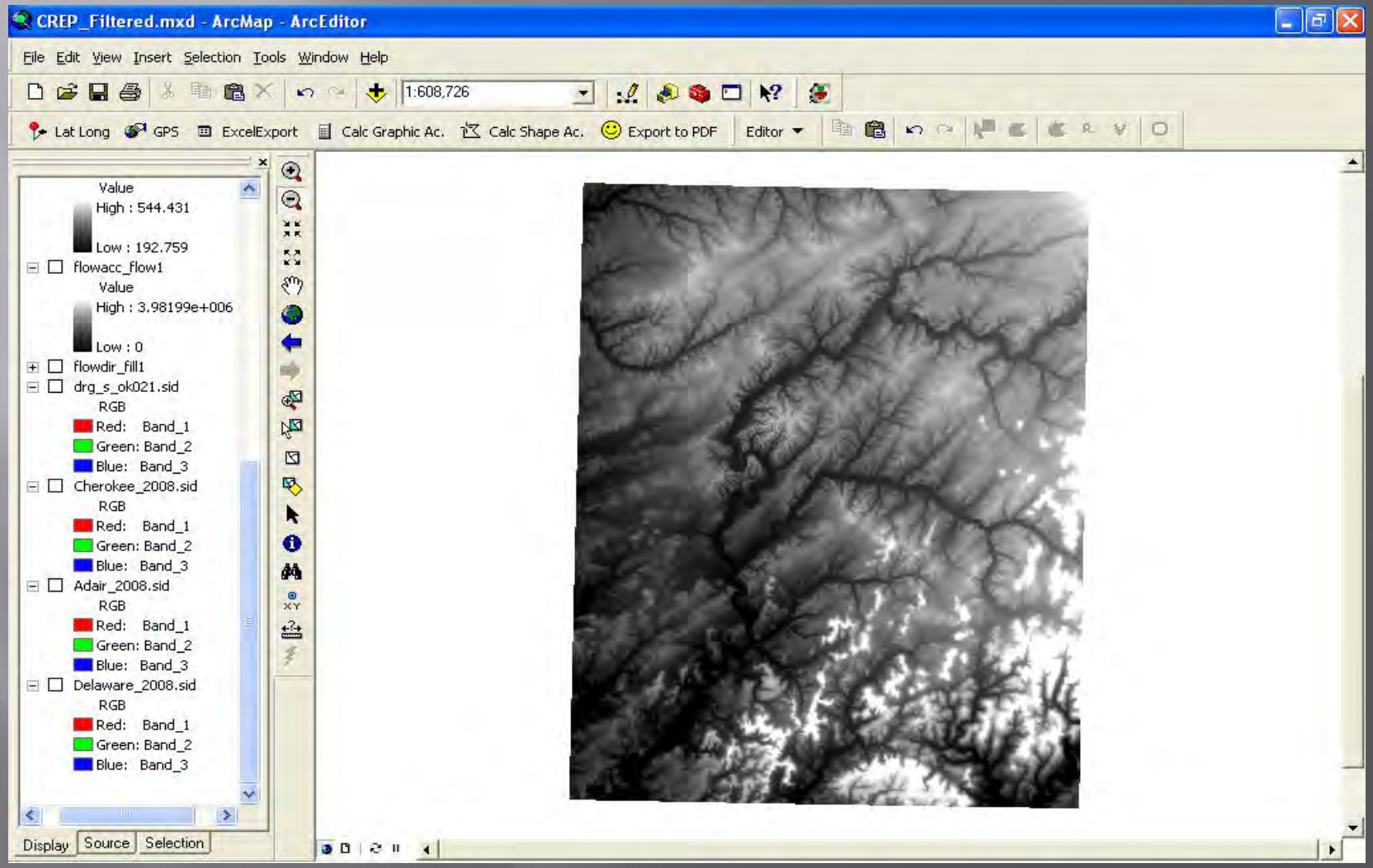
Oklahoma Conservation Commission

# Objective:

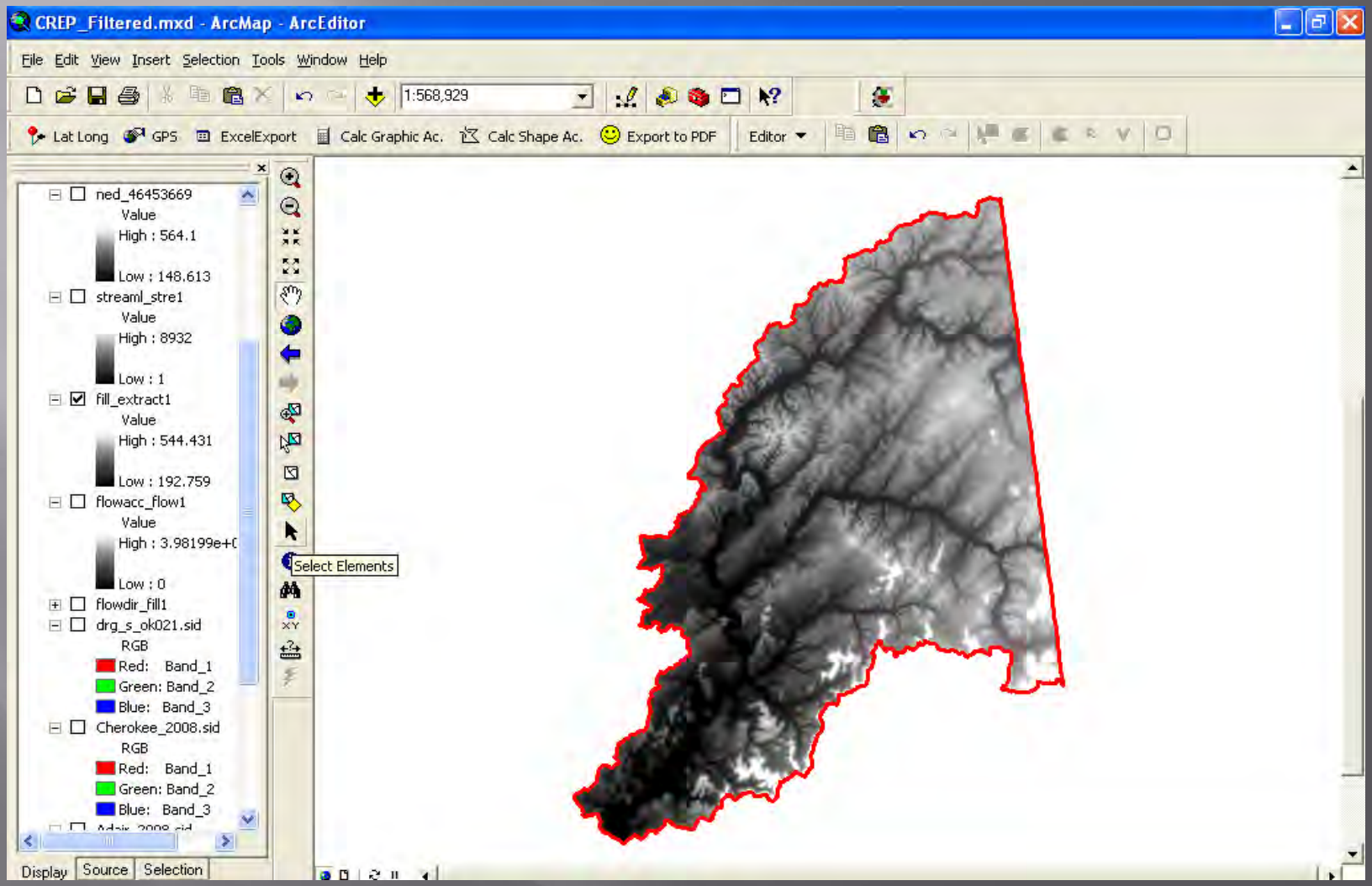
Develop an efficient method for calculating the amount of land that contributes surface runoff to each individual riparian buffer using the Hydrology toolbox in ArcMap 9.2

- Visually demonstrate the drainage areas for each buffer
- Determine the total land surface being filtered by the CREP riparian buffers
- Provide more accurate data for BMP reporting to EPA

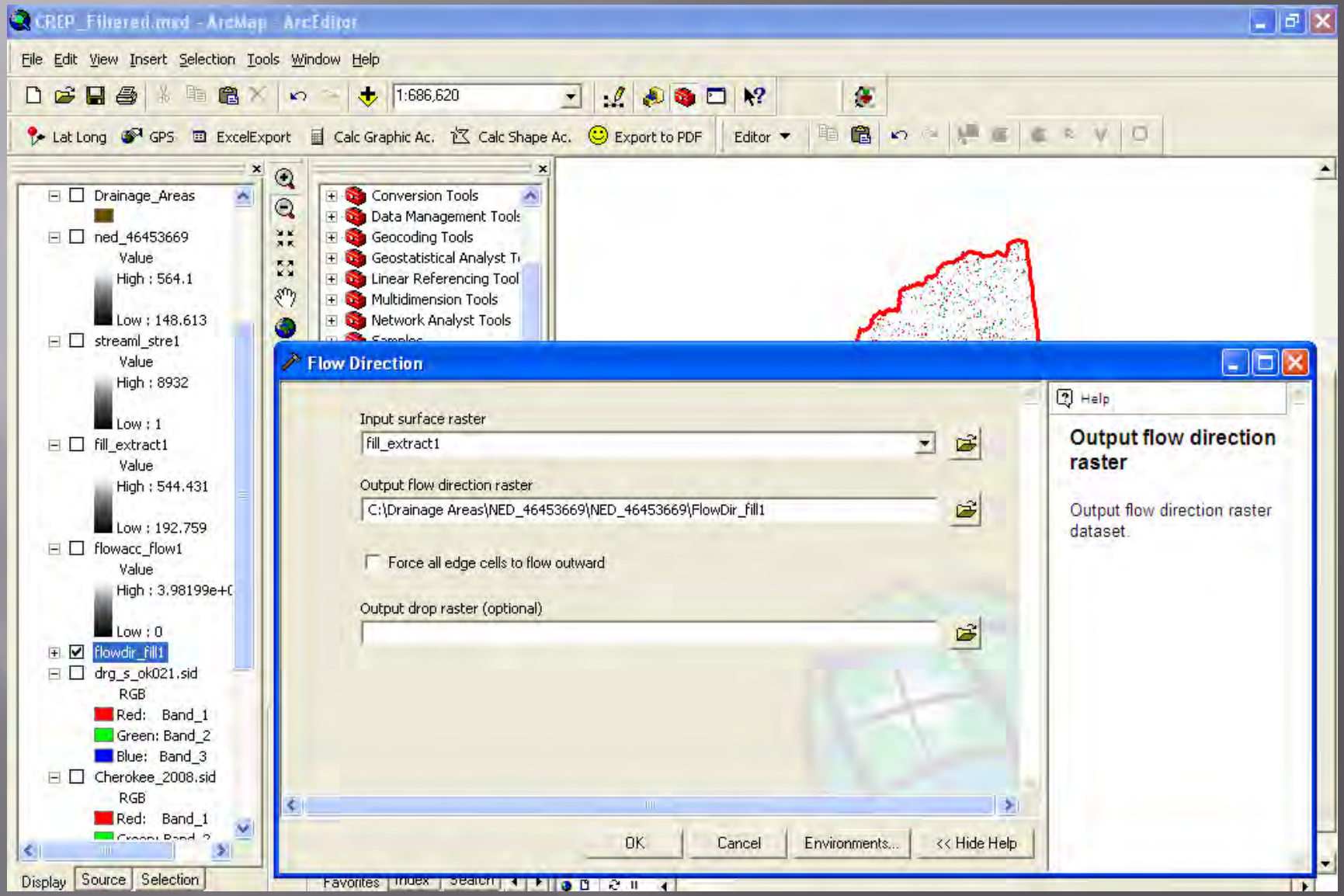
# Digital Elevation Model downloaded from http://ned.usgs.gov/



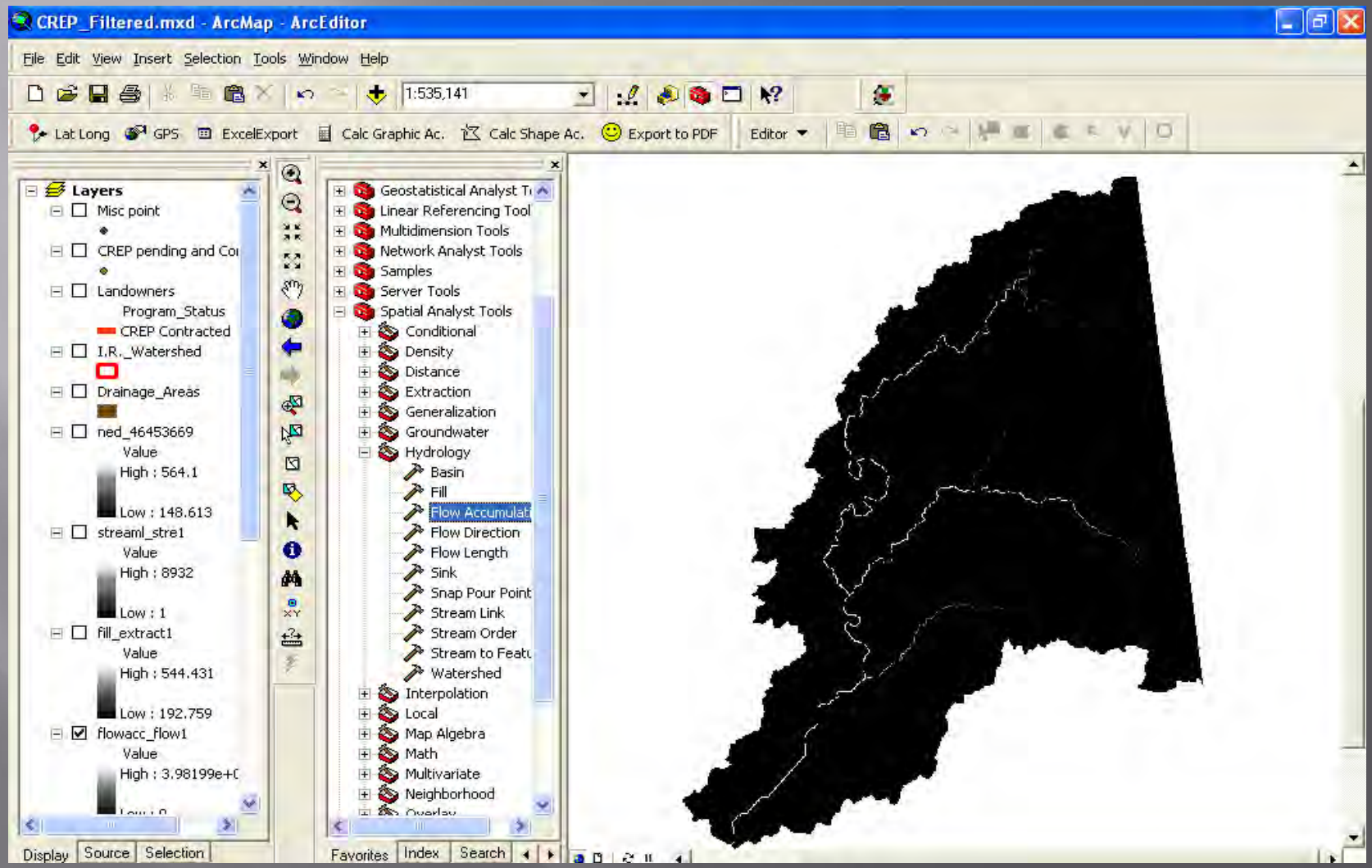
# Clipped the DEM to the watershed boundary and used the fill tool to fill any gaps in the DEM data.



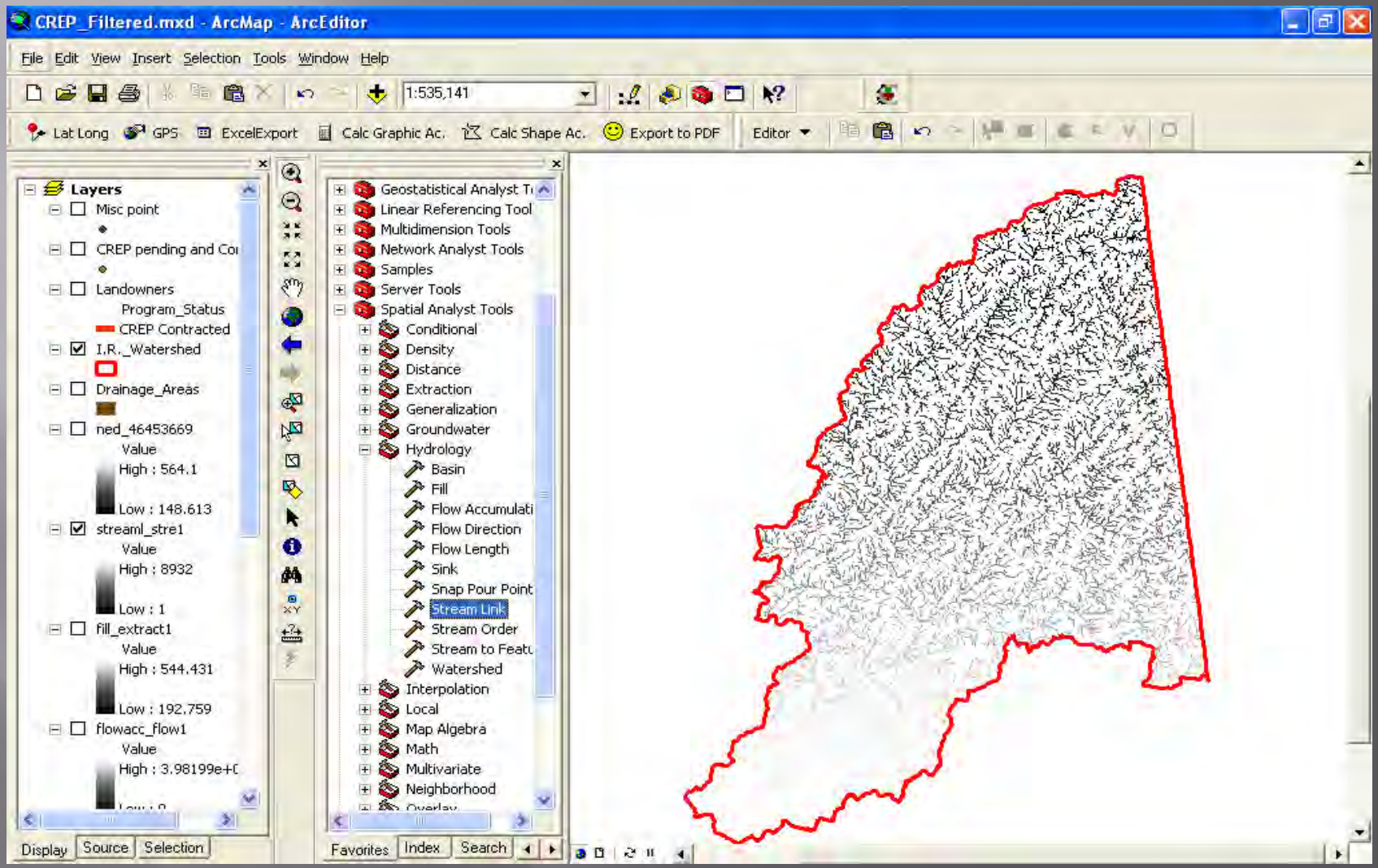
# Flow Direction



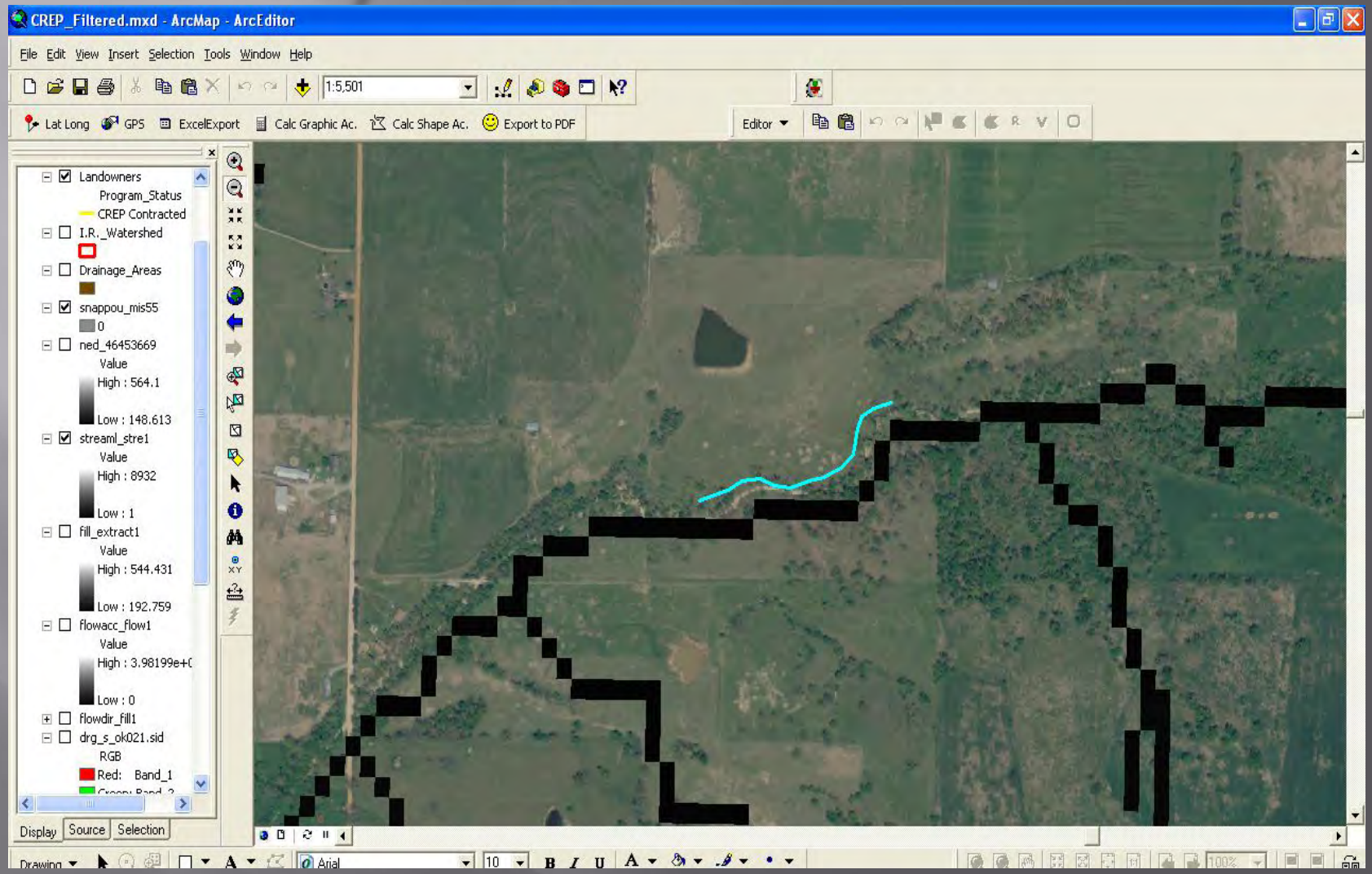
# Used Flow Direction to produce a Flow Accumulation layer



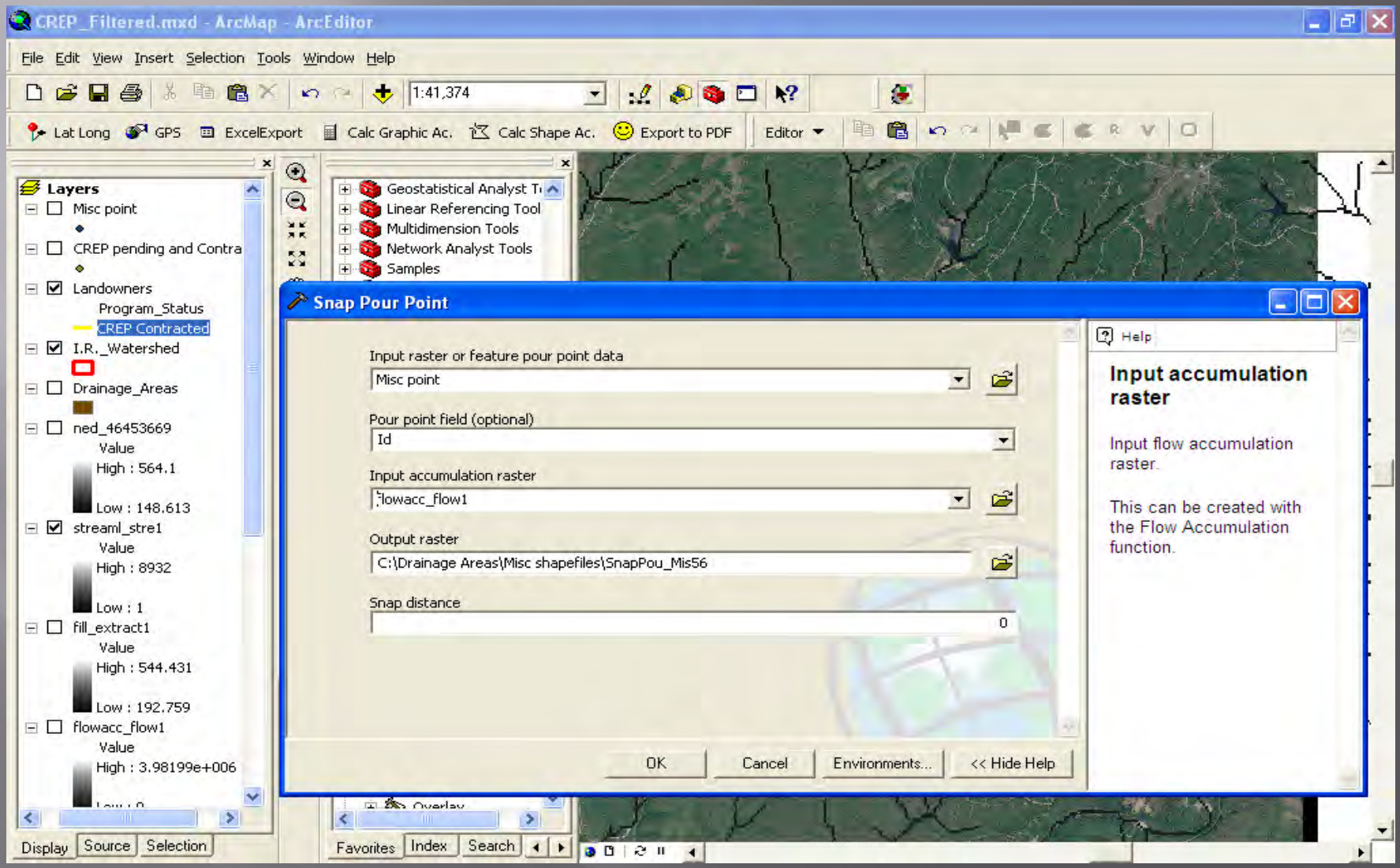
# Used Stream Link Tool to show all streams in the watershed.



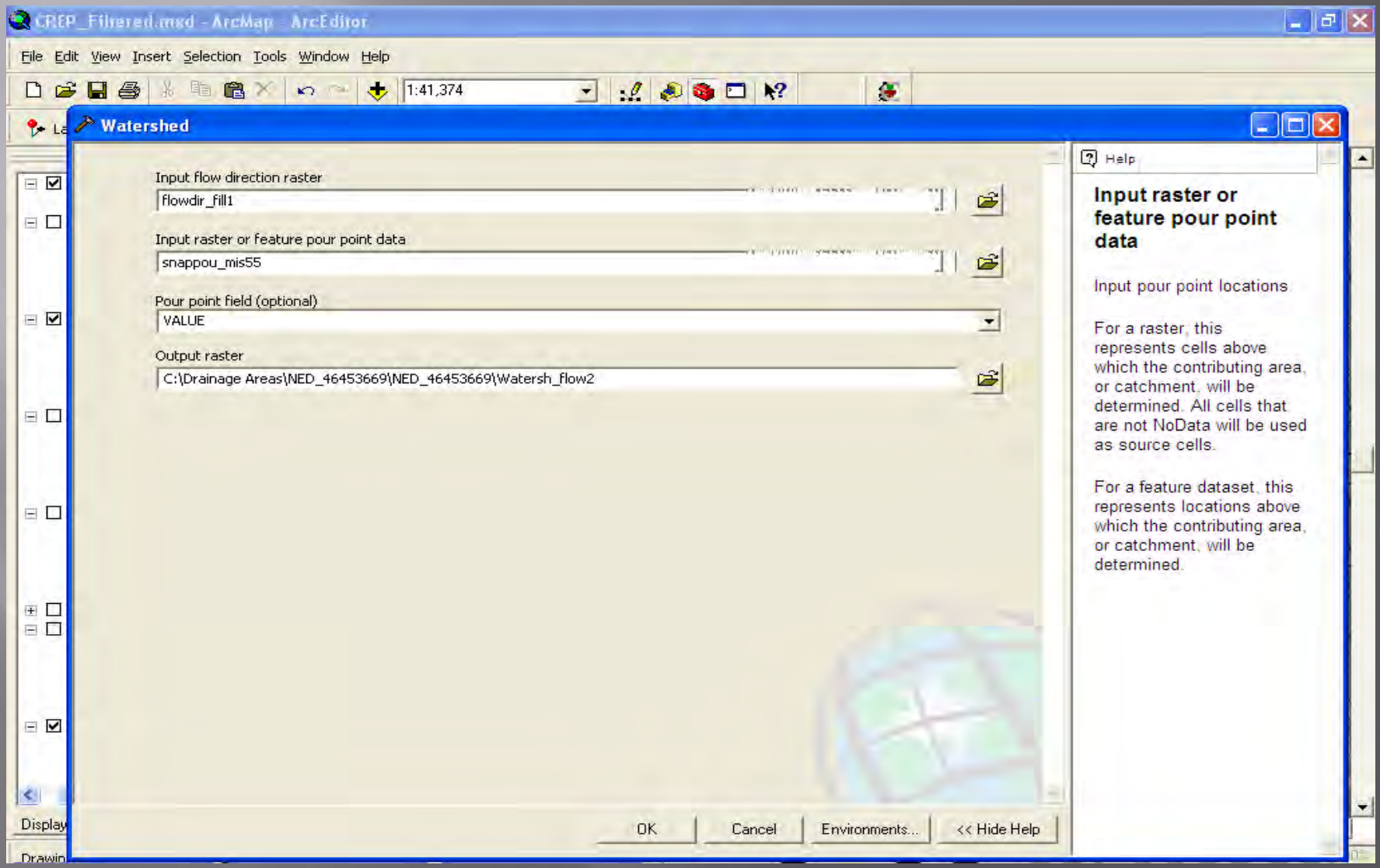
# Used the Stream Link Layer to identify location of Pour Point



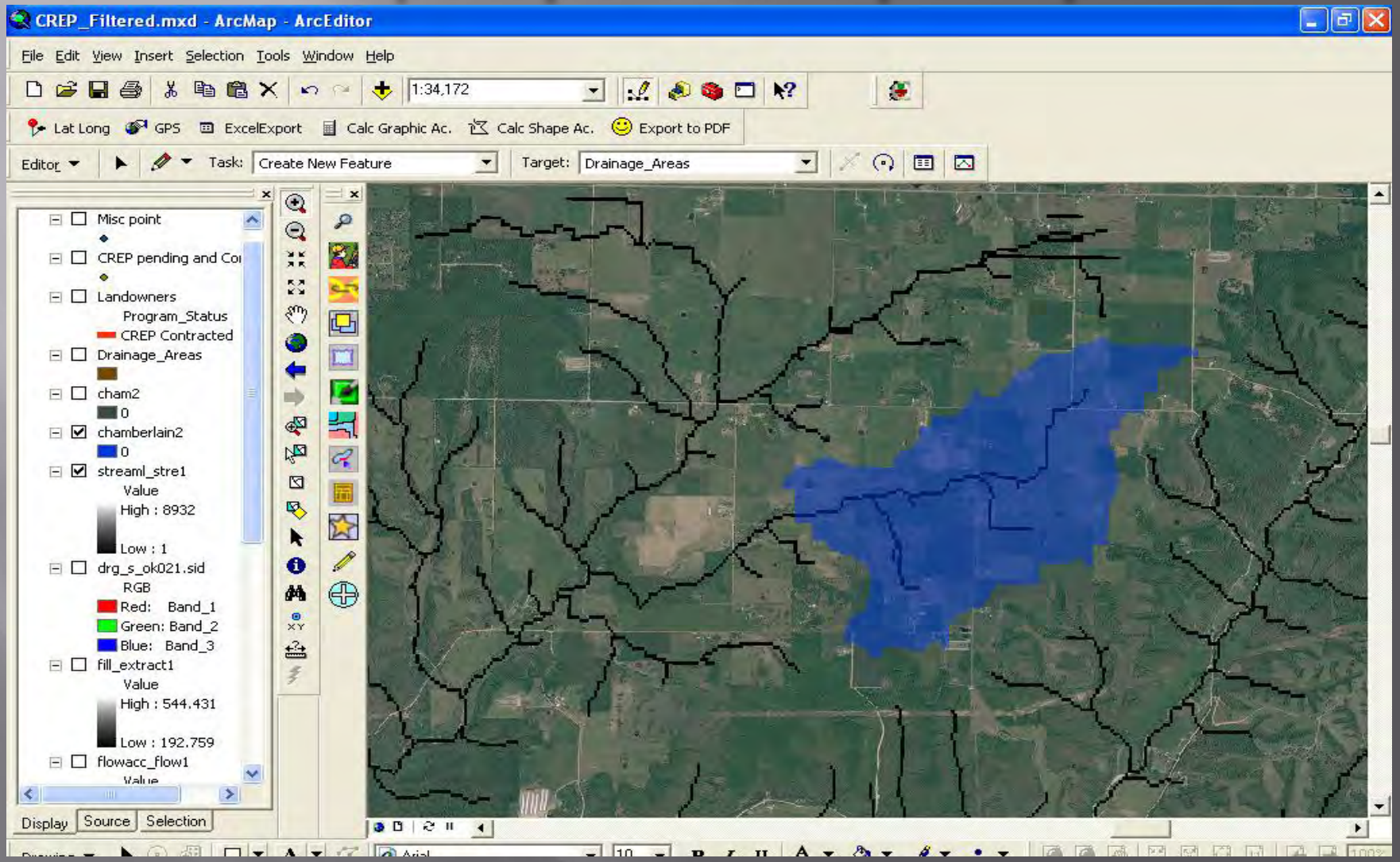
# Snap Pour Point to Flow Accumulation layer



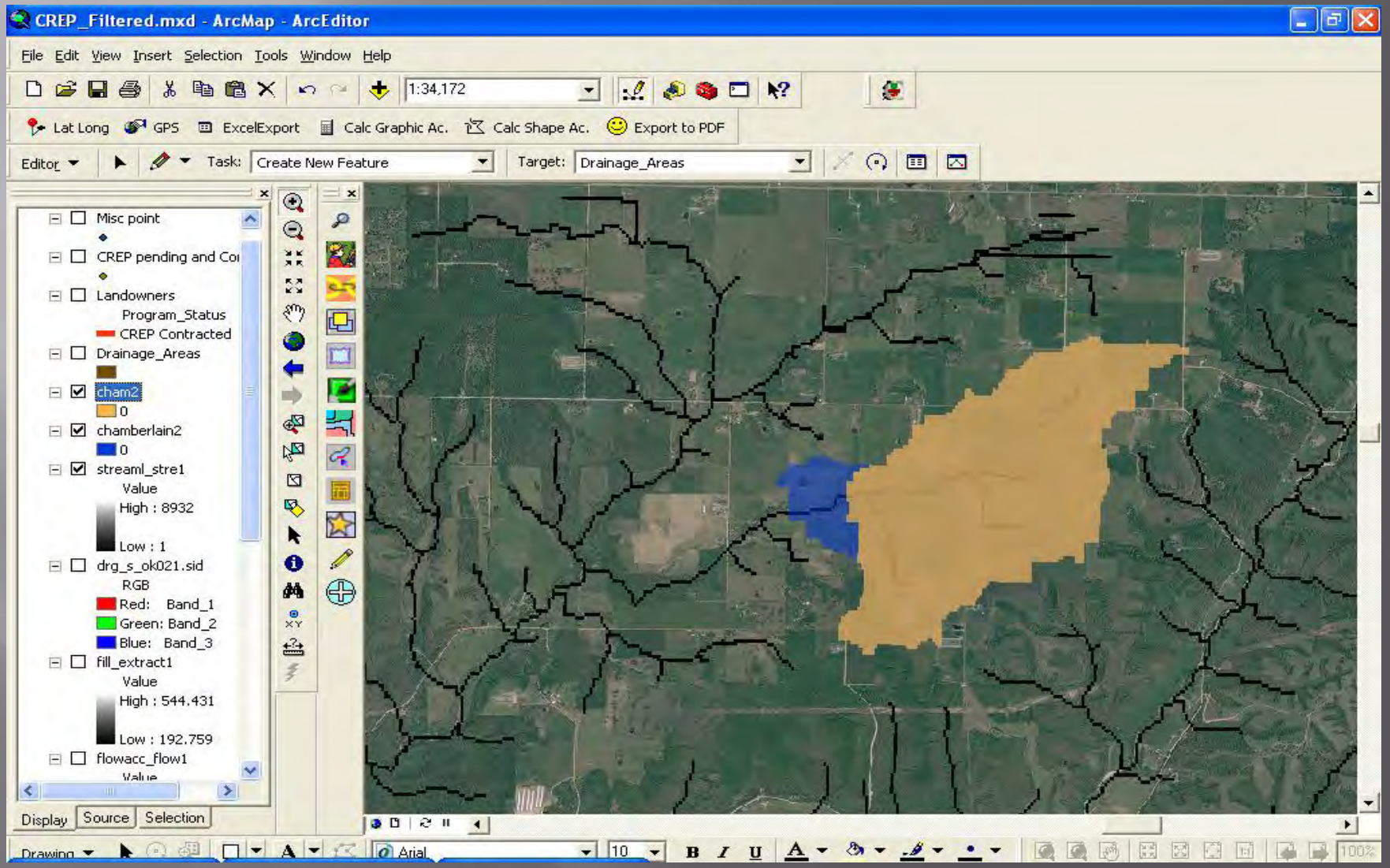
# Use Pour Point and Flow Direction to delineate a watershed



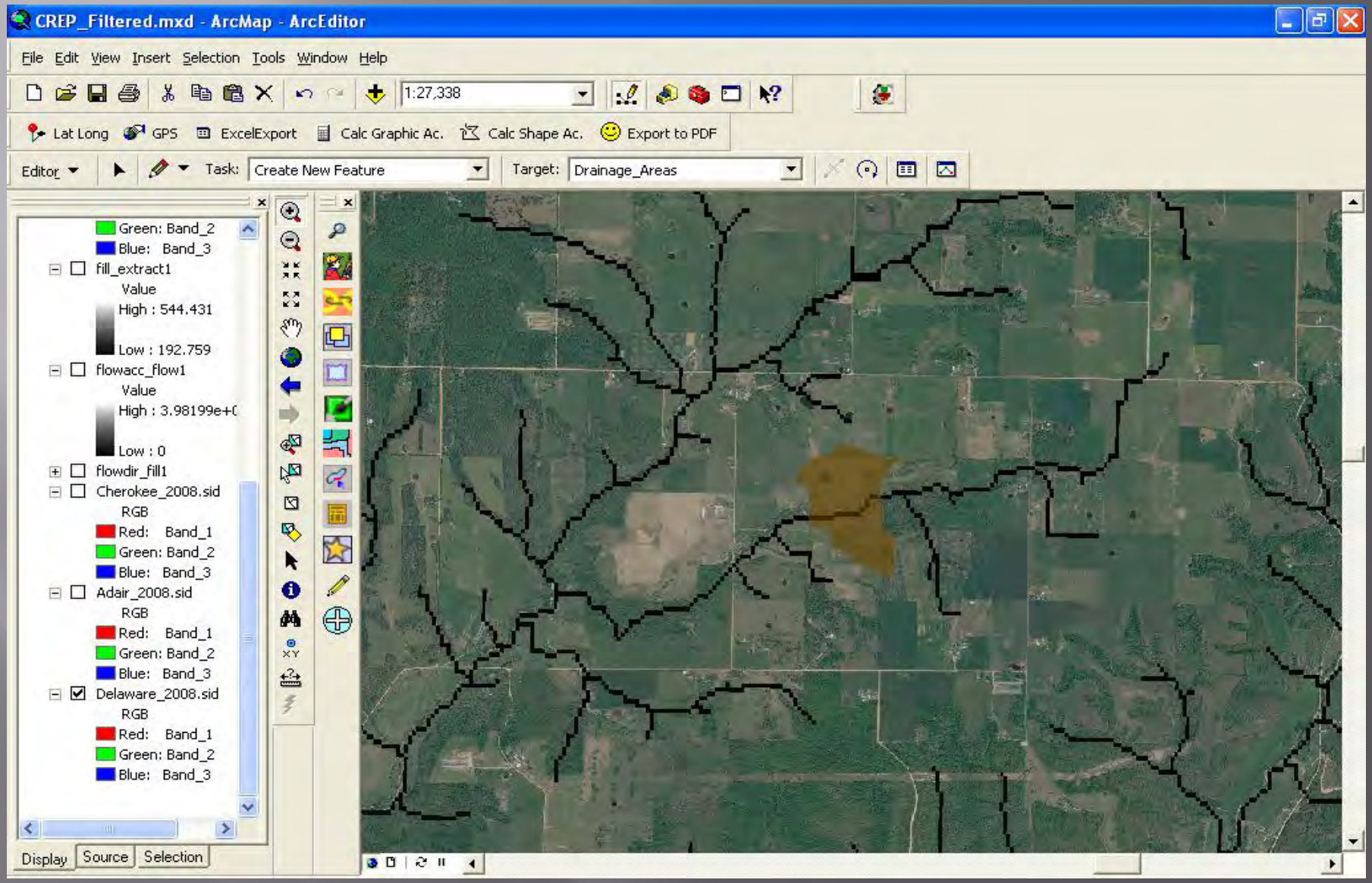
# Watershed tool is used to delineate all cells upslope of the pour point.



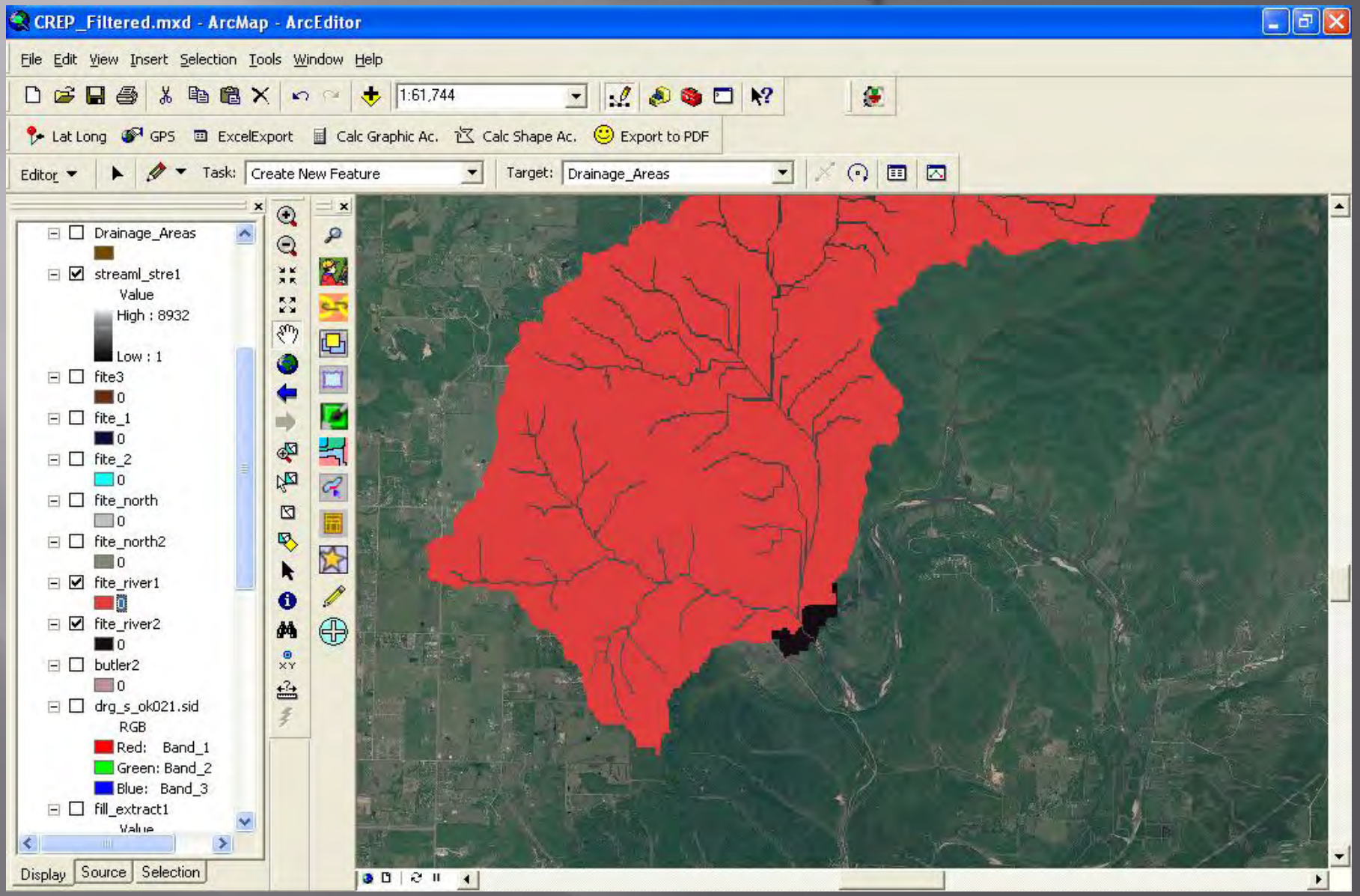
# Watershed from upstream point of the watershed.



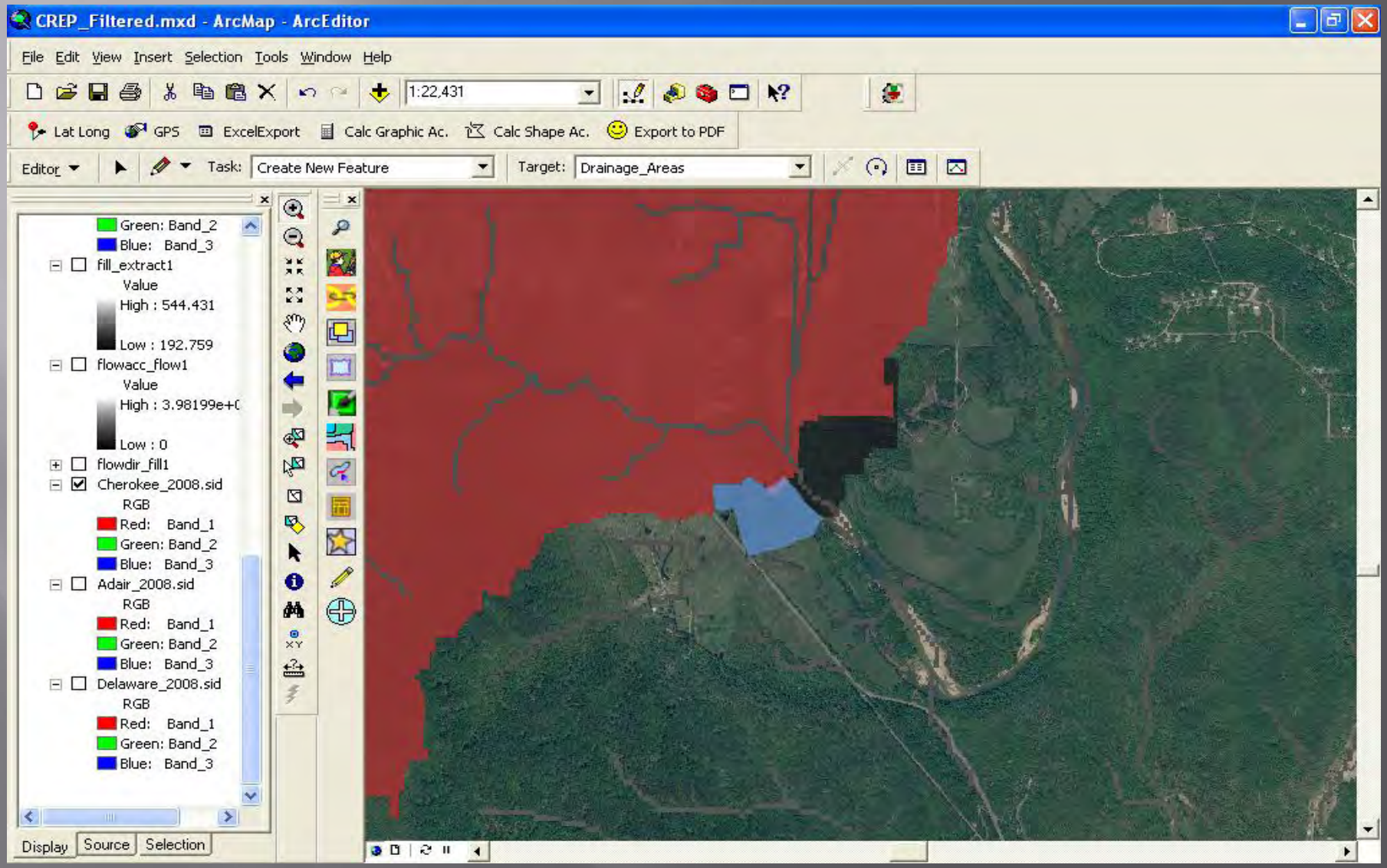
# Subtract the 2nd watershed and the remaining area shows the area draining into the CREP buffers

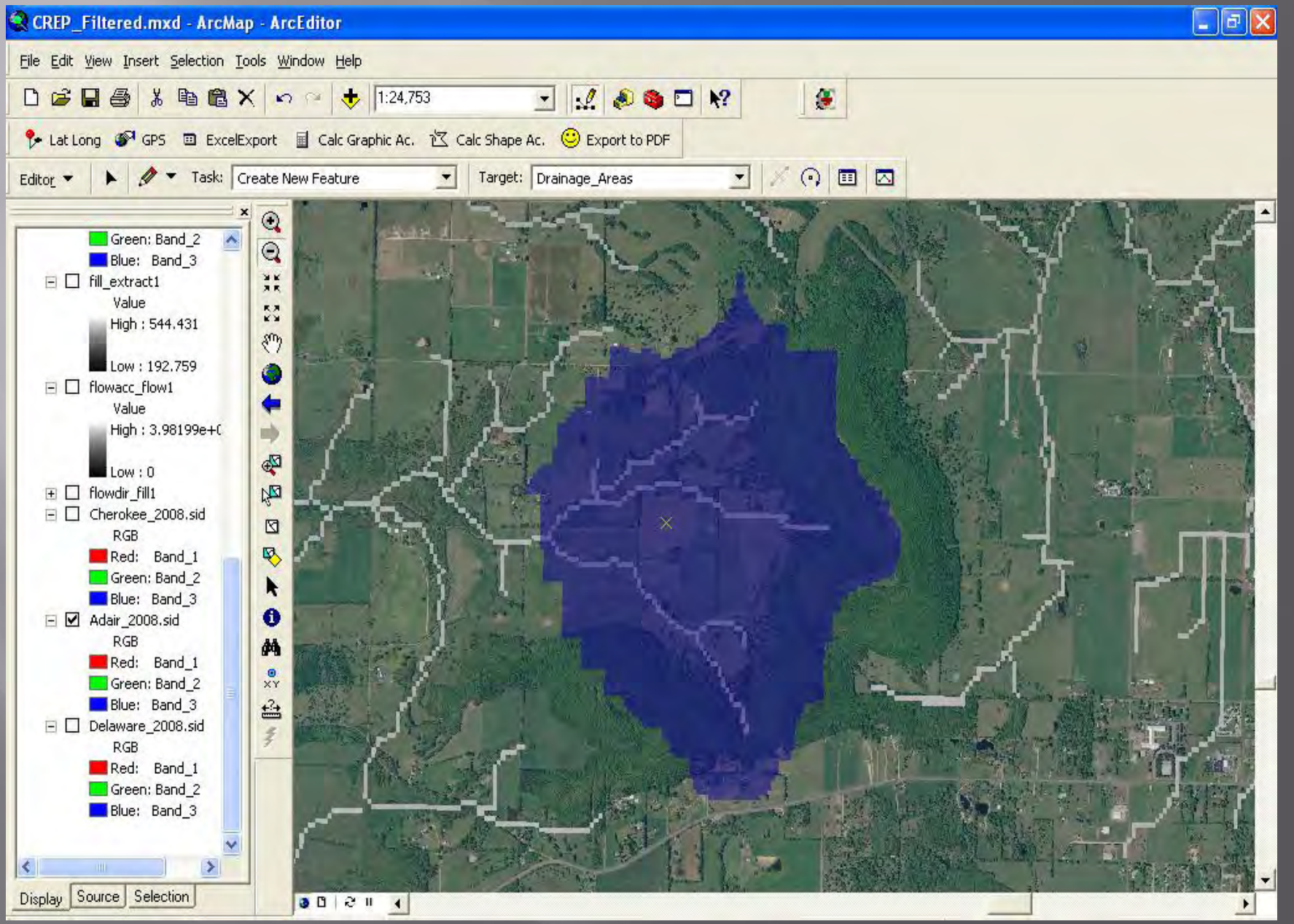


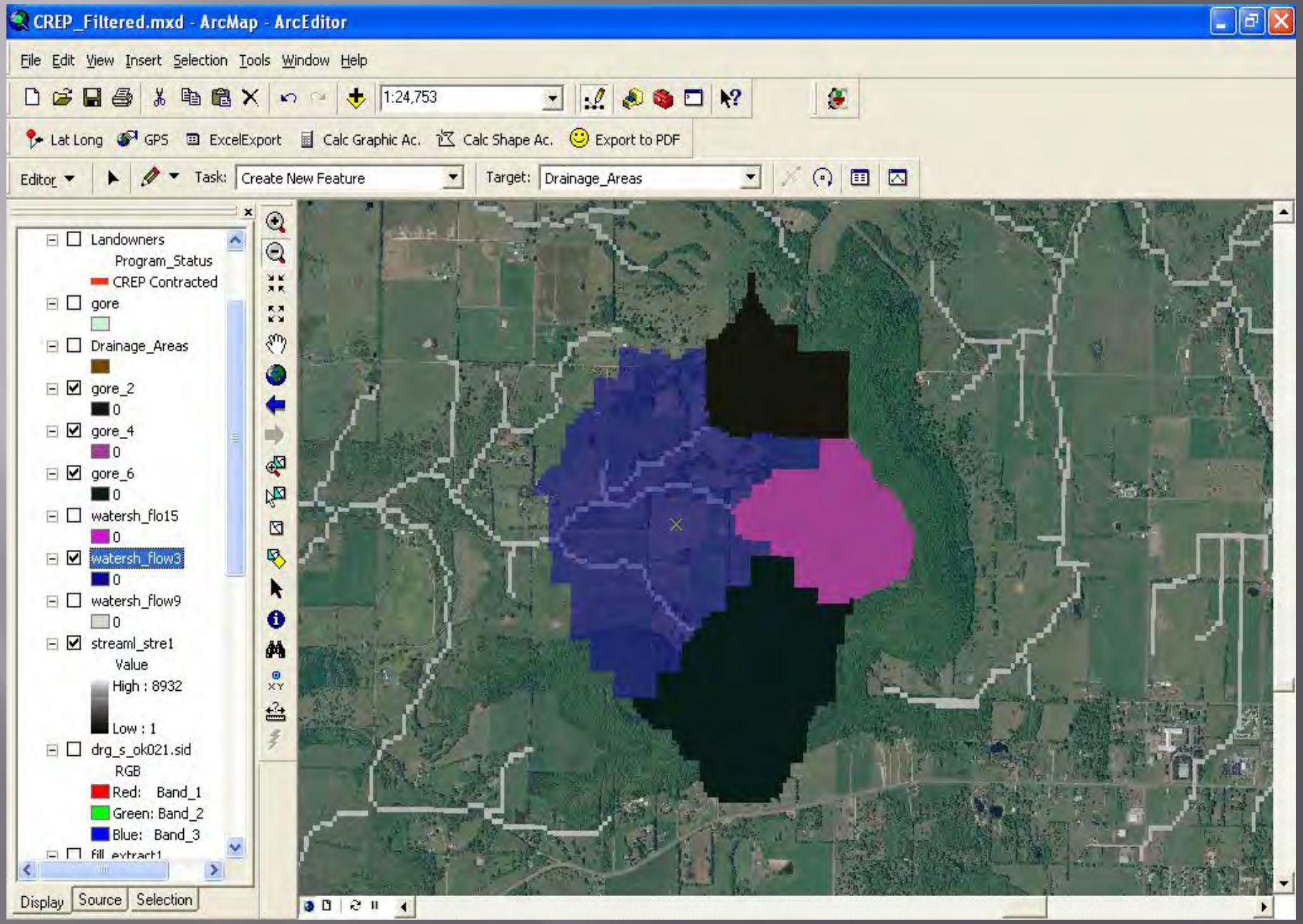
# Another Example



# Edit the drainage to the edge of the river after subtracting the upstream watershed




CREP_Filtered.mxd - ArcMap - ArcEditor
File Edit View Insert Selection Tools Window Help
1:24,753
Lat Long GPS ExcelExport Calc Graphic Ac. Calc Shape Ac. Export to PDF
Editor Task: Create New Feature Target: Drainage_Areas
Green: Band_2
Blue: Band_3
fill_extract1
Value
High : 544.431
Low : 192.759
flowacc_flow1
Value
High : 3.98199e+0
Low : 0
flowdir_fill1
Cherokee_2008.sid
RGB
Red: Band_1
Green: Band_2
Blue: Band_3
Adair_2008.sid
RGB
Red: Band_1
Green: Band_2
Blue: Band_3
Delaware_2008.sid
RGB
Red: Band_1
Green: Band_2
Blue: Band_3
Display Source Selection


CREP_Filtered.mxd - ArcMap - ArcEditor
File Edit View Insert Selection Tools Window Help
1:24,753
Lat Long GPS ExcelExport Calc Graphic Ac. Calc Shape Ac. Export to PDF
Editor Task: Create New Feature Target: Drainage_Areas
Landowners
Program_Status
CREP Contracted
gore
Drainage_Areas
gore_2
0
gore_4
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gore_6
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watersh_flo15
0
watersh_flow3
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watersh_flow9
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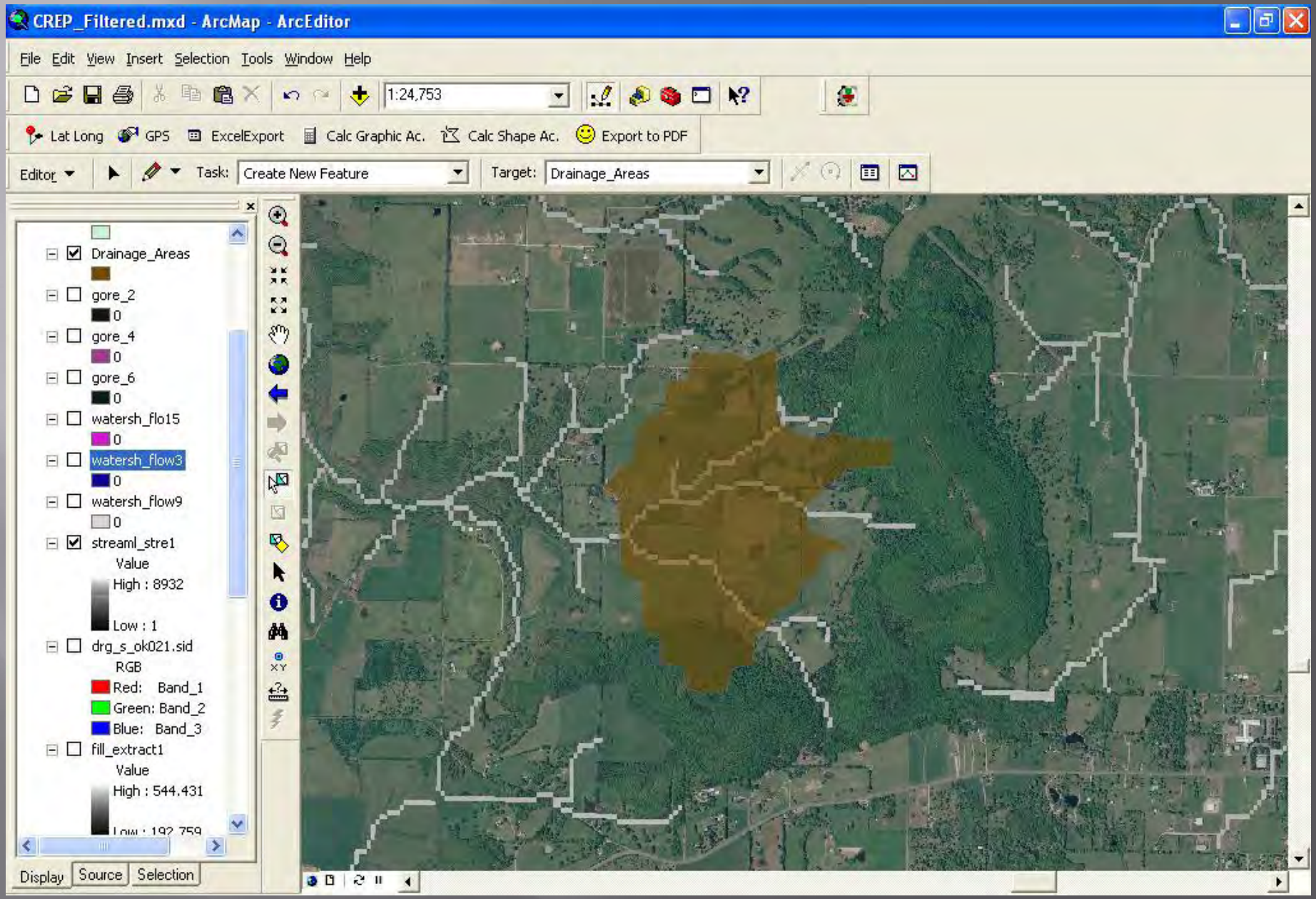
streaml_stre1
Value
High : 8932
Low : 1
drg_s_ok021.sid
RGB
Red: Band_1
Green: Band_2
Blue: Band_3
Display Source Selection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File Edit View Insert Selection Tools Window Help
1:24,753
Lat Long GPS ExcelExport Calc Graphic Ac. Calc Shape Ac. Export to PDF
Editor Task: Create New Feature Target: Drainage_Areas
Drainage_Areas
gore_2
0
gore_4
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gore_6
0
watersh_flo15
0
watersh_flow3
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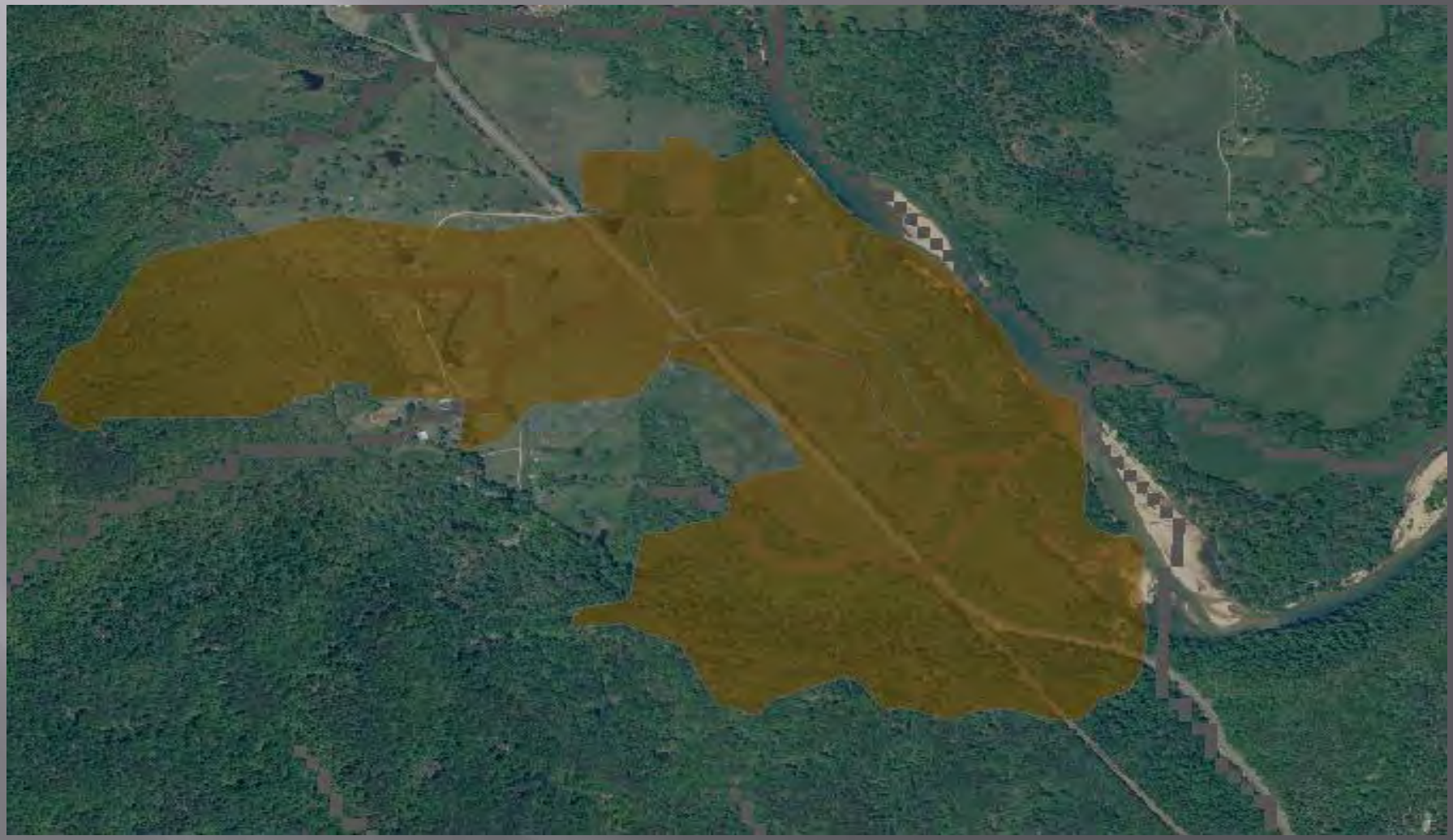
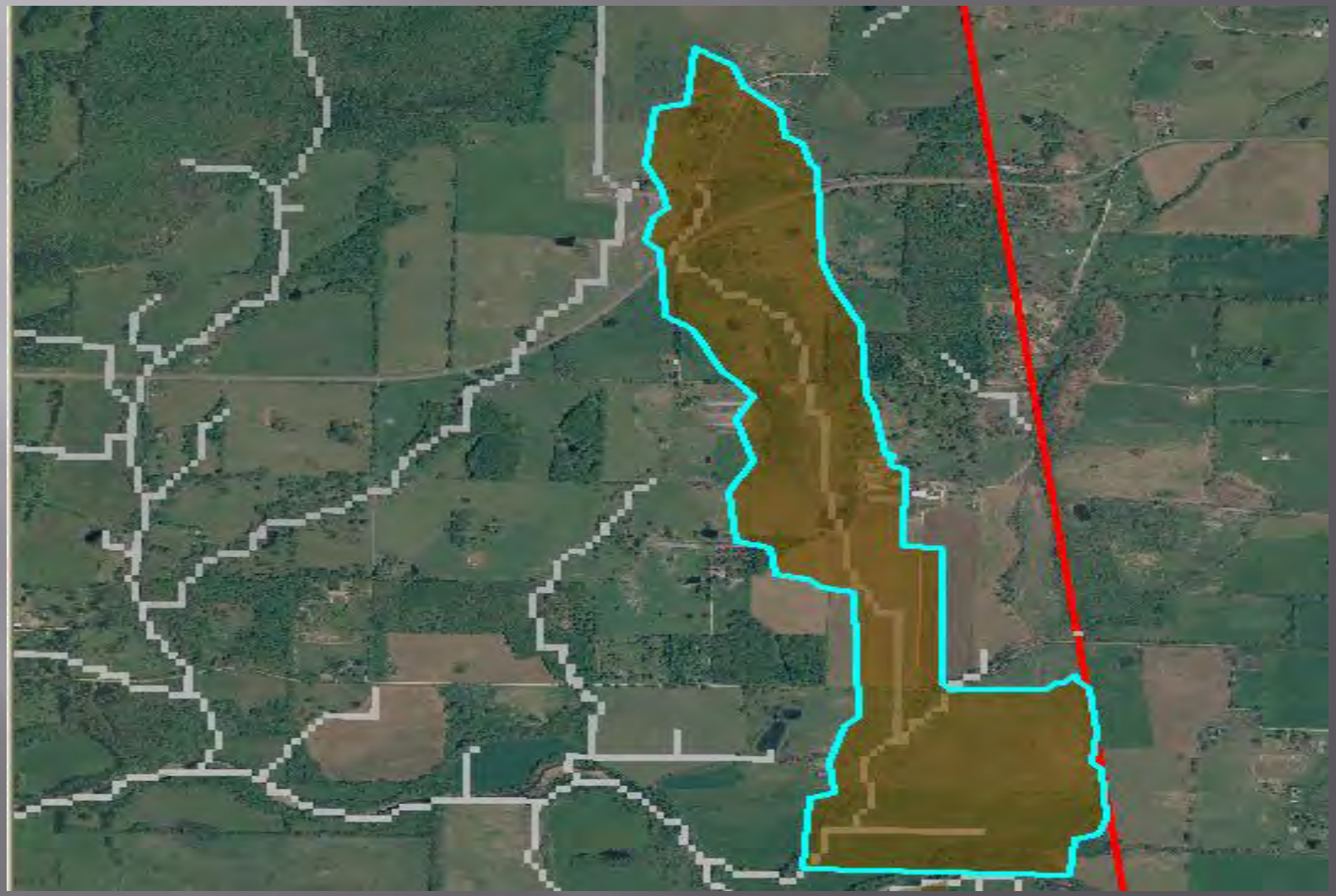
watersh_flow9
0
streaml_stre1
Value
High : 8932
Low : 1
drg_s_ok021.sid
RGB
Red: Band_1
Green: Band_2
Blue: Band_3
fill_extract1
Value
High : 544.431
Display Source Selection

# 46 acres of riparian buffer with a 255 acre drainage area



# 11 acres of riparian buffer with a 350 acre drainage area



Attributes of Drainage_Areas

| Buffer_Area | Filtered_Area | SHAPE_Length | SHAPE_Area |
|---|---|---|---|
| 3 | 11 | 927.346488 | 44068.787478 |
| 8 | 78 | 2963.765207 | 318039.534725 |
| 6 | 26 | 1368.458541 | 105261.006143 |
| 12 | 33 | 1876.528507 | 134635.953407 |
| 9 | 183 | 4576.313408 | 743706.414462 |
| 1 | 5 | 709.317064 | 21280.802739 |
| 1 | 2 | 436.563346 | 8150.084127 |
| 1 | 169 | 3608.811533 | 687672.164447 |
| 14 | 126 | 4971.683666 | 511338.043469 |
| 13 | 158 | 4796.124138 | 640565.425693 |
| 4 | 90 | 2981.822461 | 367393.862933 |
| 3 | 8 | 731.758303 | 32015.379795 |
| 17 | 338 | | |
| 1 | 11 | | |
| 14 | 272 | | |
| 1 | 15 | | |
| 2 | 44 | | |
| 2 | 41 | | |
| 2 | 36 | | |
| 2 | 28 | | |
| 8 | 232 | | |
| 7 | 31 | | |
| 9 | 40 | | |
| 40 | 479 | | |
| 15 | 66 | | |
| 8 | 381 | | |
| 1 | 2 | | |
| 6 | 47 | | |
| 3 | 38 | | |
| 25 | 52 | 2497.11388 | 208420.605483 |
| 3 | 7 | 687.113819 | 28608.872126 |
| 3 | 130 | 3877.425229 | 528759.050332 |
| 19 | 130 | 3609.875041 | 410142.882607 |
| 7 | 18 | 1135.547927 | 73472.469921 |
| 32 | 135 | 4424.978428 | 547098.170776 |
| 11 | 350 | 8542.22307 | 1420901.158356 |
| 24 | 195 | 4631.408136 | 788977.239663 |

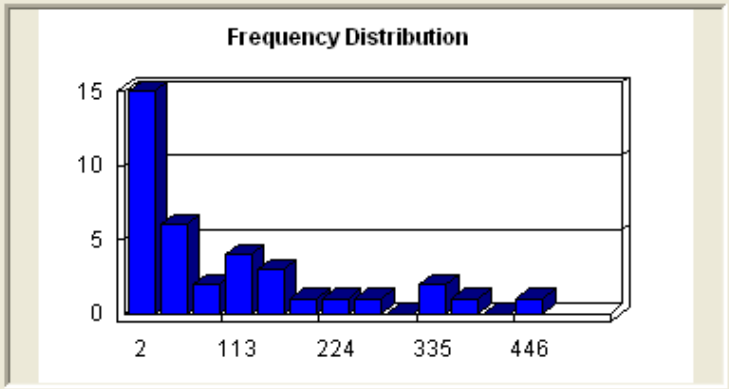
Statistics of Drainage_Areas

Field

Filtered_Area

Statistics:

Count: 37
Minimum: 2
Maximum: 479
Sum: 4007
Mean: 108.297297
Standard Deviation: 120.135479



# Limitations

- Determines the drainage area based on slope
- Does not factor in soil type, roads, ponds, etc.
- Larger streams do not line up as well with flow accumulation layer due to movement of stream channel
- Missing Buffers
- Does not factor in buffer width

# Conclusion

- Average Buffer Size = 9 ac
- Average Drainage Area = 108 ac
- On avg. every CREP acre drains 12 acres
- Total of 4007 acres draining into 337 buffer acres
- Relatively easy way to determine a watershed for a smaller specific area
  - Most uses for these tools have been for a full stream segment
- The drainage areas can be used in the Spreadsheet Tool for Estimating Pollutant Load (STEPL) (http://it.tetratech-ffx.com/stepl/)
  - Used to calculate nutrient and sediment load reductions from implementation of various BMPs.
  - Requires an estimate of drainage areas for riparian buffers

# Questions or Suggestions?