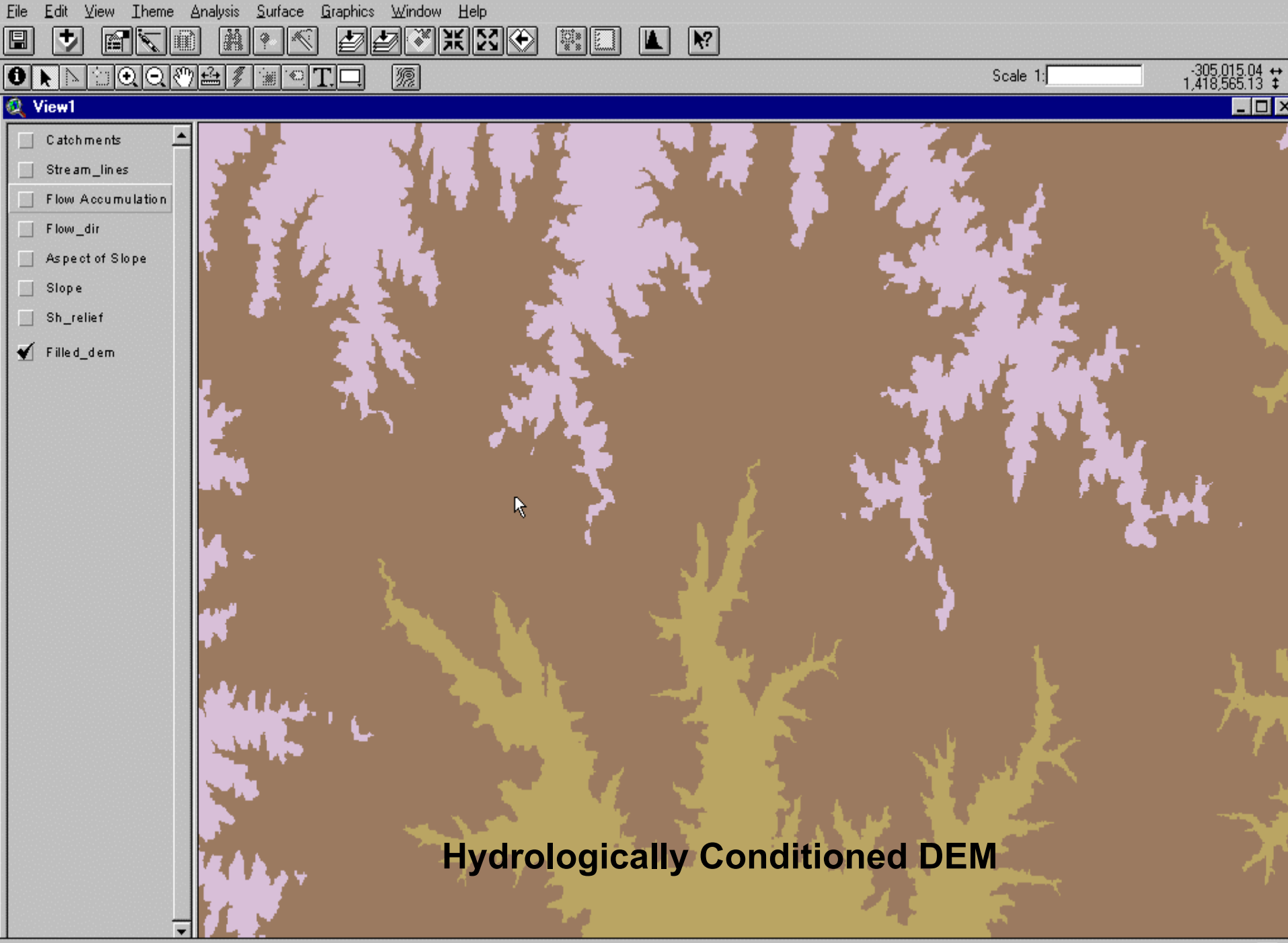
Tools for Automated Watershed Delineation As Implemented in the Elevation Derivatives for National Applications (EDNA) Dataset

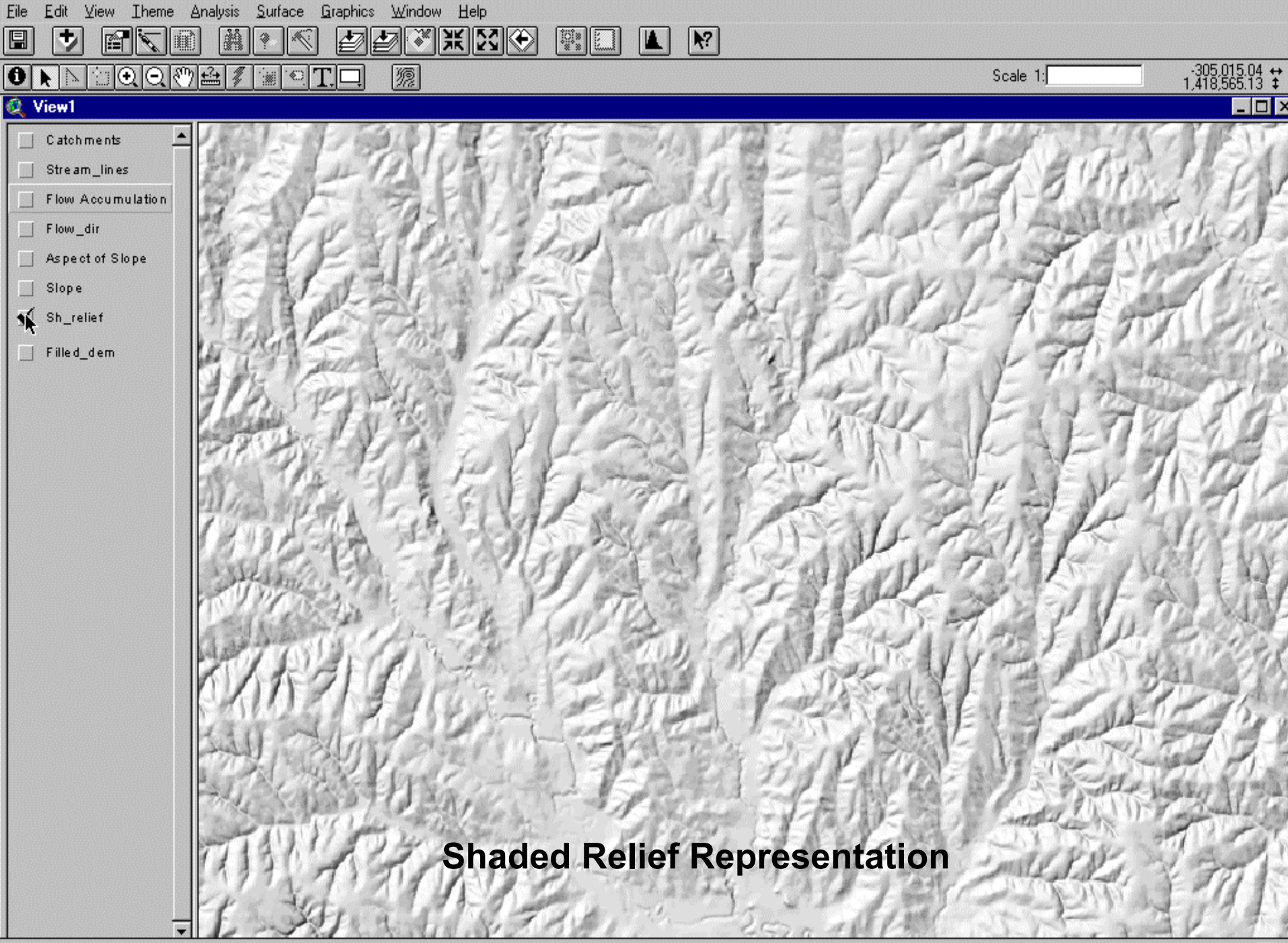
Susan Greenlee

USGS

Elevation Derivatives for National Applications (EDNA)

- Collaborative effort to create common topographically-derived data layers in systematic and consistent manner for the U.S.
- Currently, derived from 1-arc-second NED
- Multi-layer data set (raster & vector)
- National Albers projection, 30 meter cell size


File Edit View Theme Analysis Surface Graphics Window Help
Scale 1:
-305,015.04
1,418,565.13
View1
Catchments
Stream_lines
Flow Accumulation
Flow_dir
Aspect of Slope
Slope
Sh_relief
Filled_dem
Hydrologically Conditioned DEM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Scale 1:
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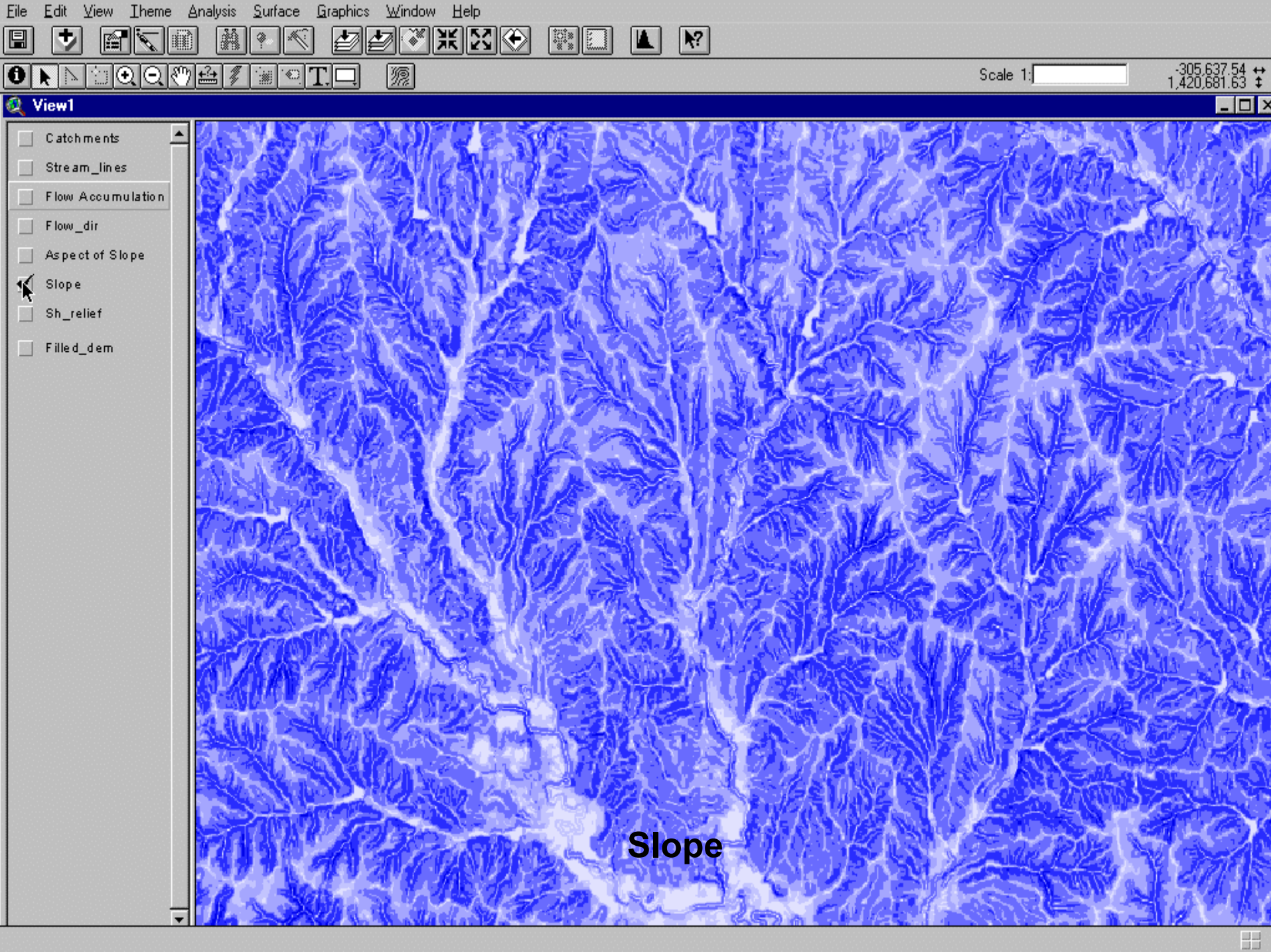
1,418,565.13
View1
Catchments
Stream_lines
Flow Accumulation
Flow_dir
Aspect of Slope
Slope
Sh_relief
Filled_dem
Shaded Relief Representation


File Edit View Theme Analysis Surface Graphics Window Help
Scale 1:
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1,420,681.63
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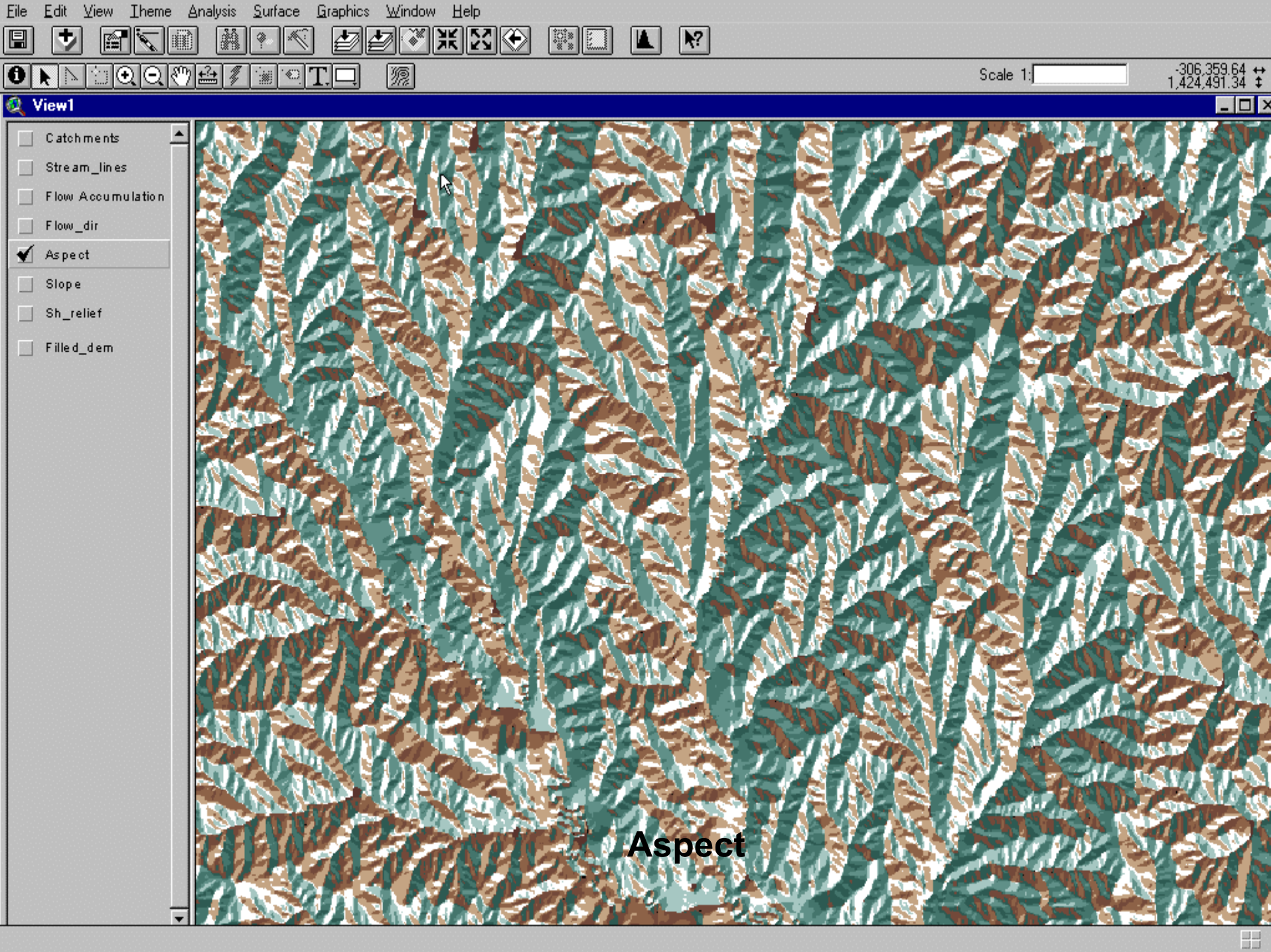
Catchments
Stream_lines
Flow Accumulation
Flow_dir
Aspect of Slope
Slope
Sh_relief
Filled_dem
Slope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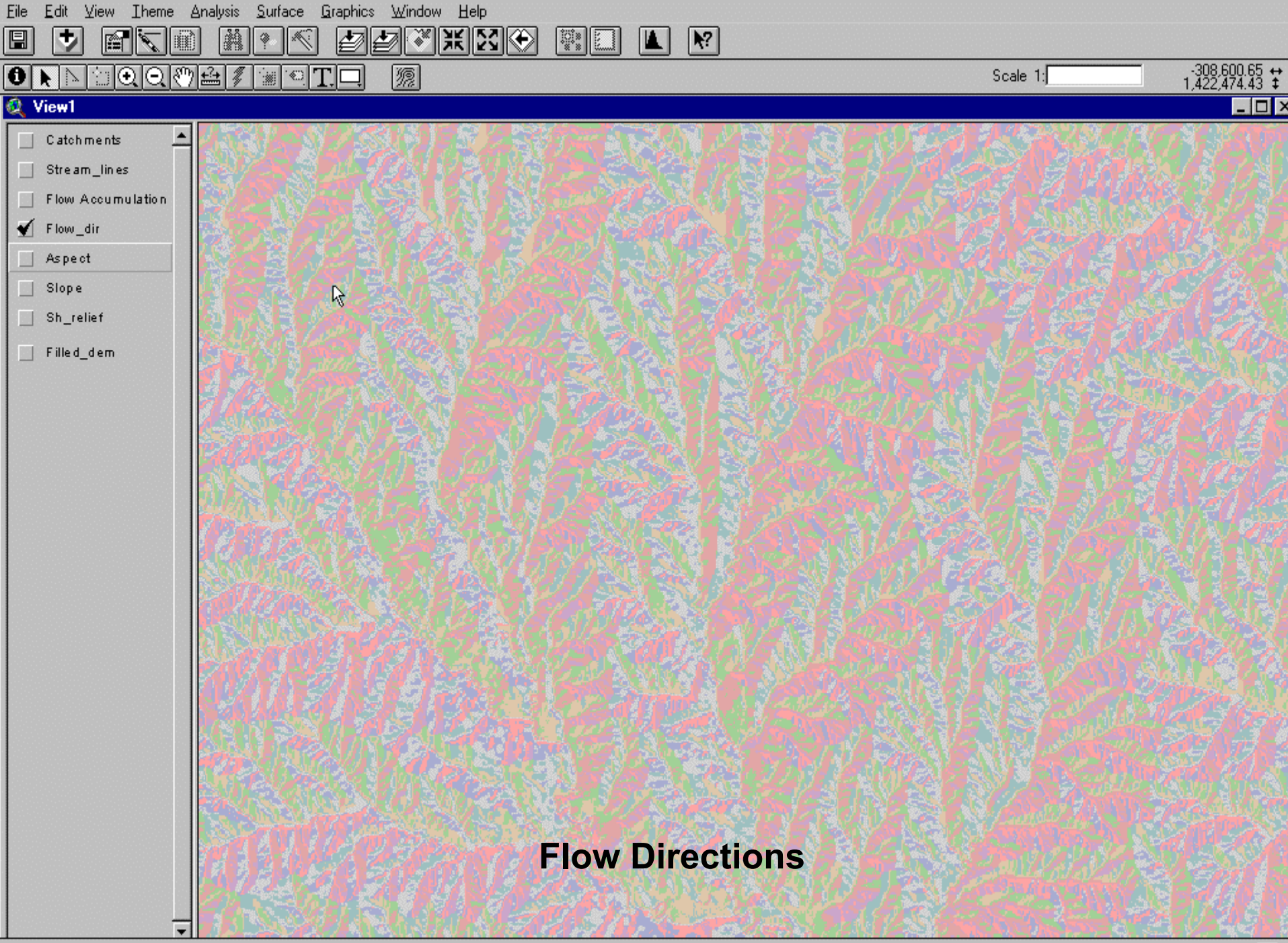
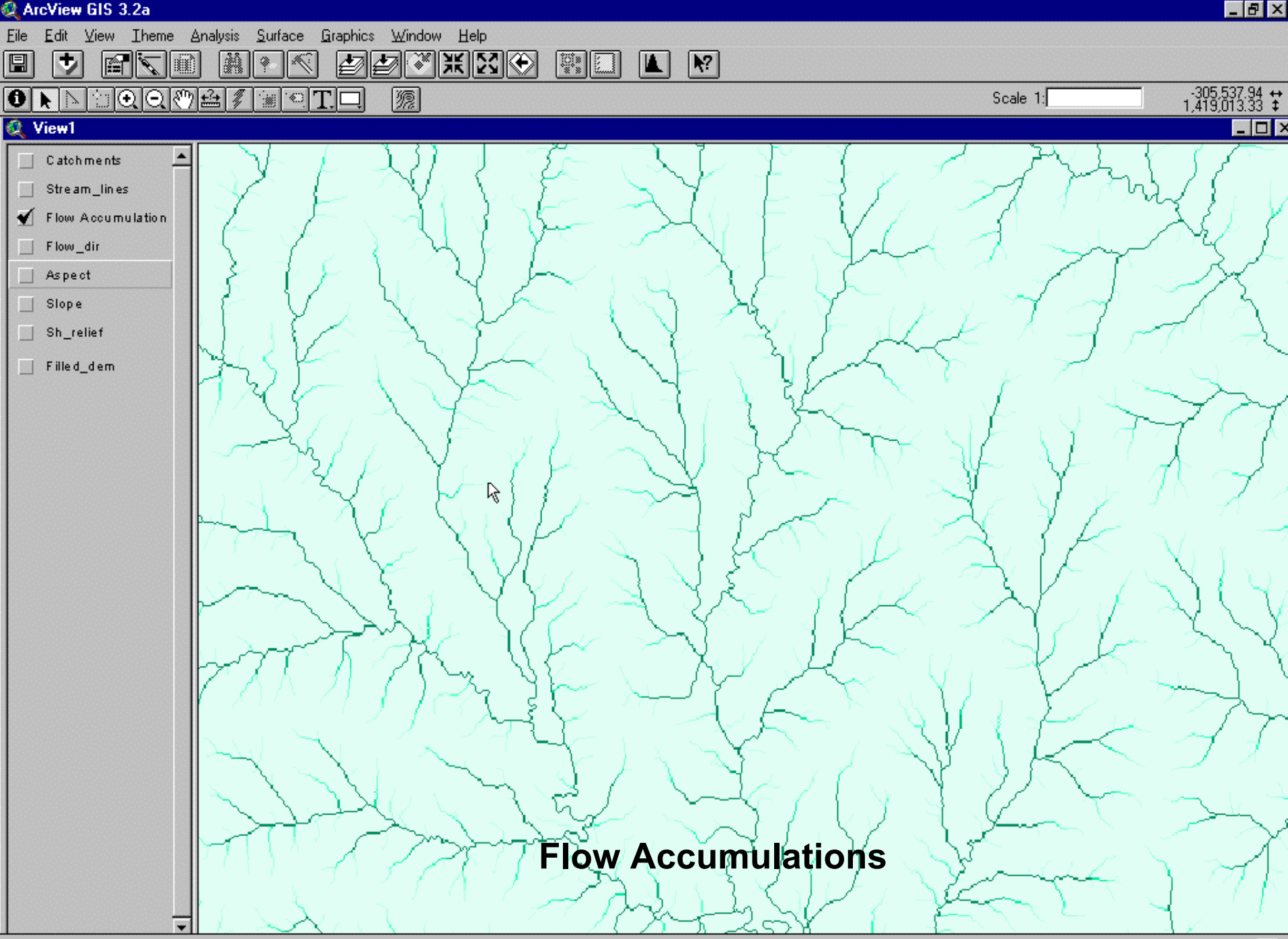
View1
Catchments
Stream_lines
Flow Accumulation
Flow_dir
Aspect
Slope
Sh_relief
Filled_dem
Aspect


File Edit View Theme Analysis Surface Graphics Window Help
Scale 1:
-308,600.65
1,422,474.43
View1
Catchments
Stream_lines
Flow Accumulation
Flow_dir
Aspect
Slope
Sh_relief
Filled_dem
Flow Directions


ArcView GIS 3.2a
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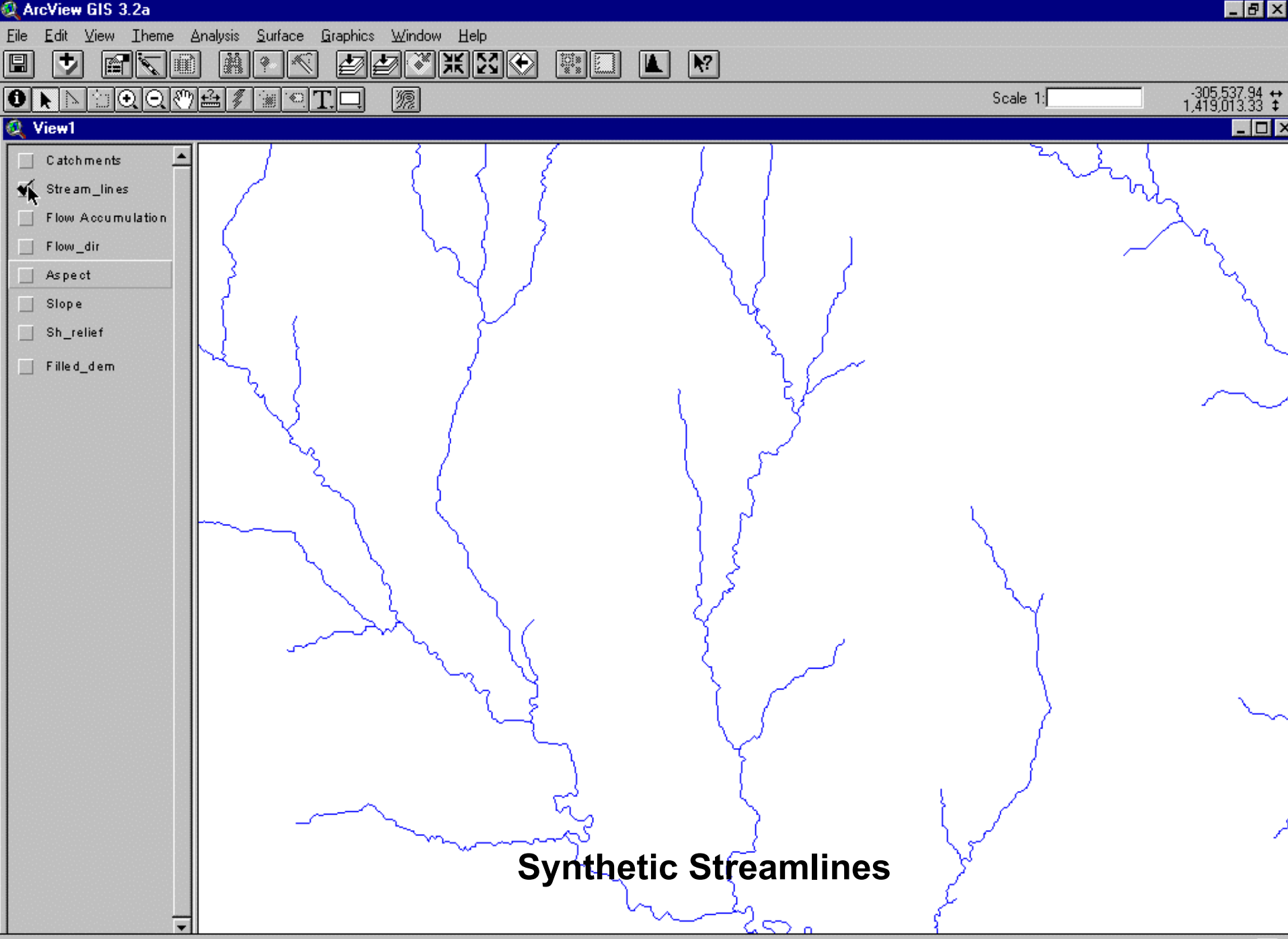
1,419,013.33
View1
Catchments
Stream_lines
Flow Accumulation
Flow_dir
Aspect
Slope
Sh_relief
Filled_dem
Flow Accumulations


ArcView GIS 3.2a
File Edit View Theme Analysis Surface Graphics Window Help
Scale 1:
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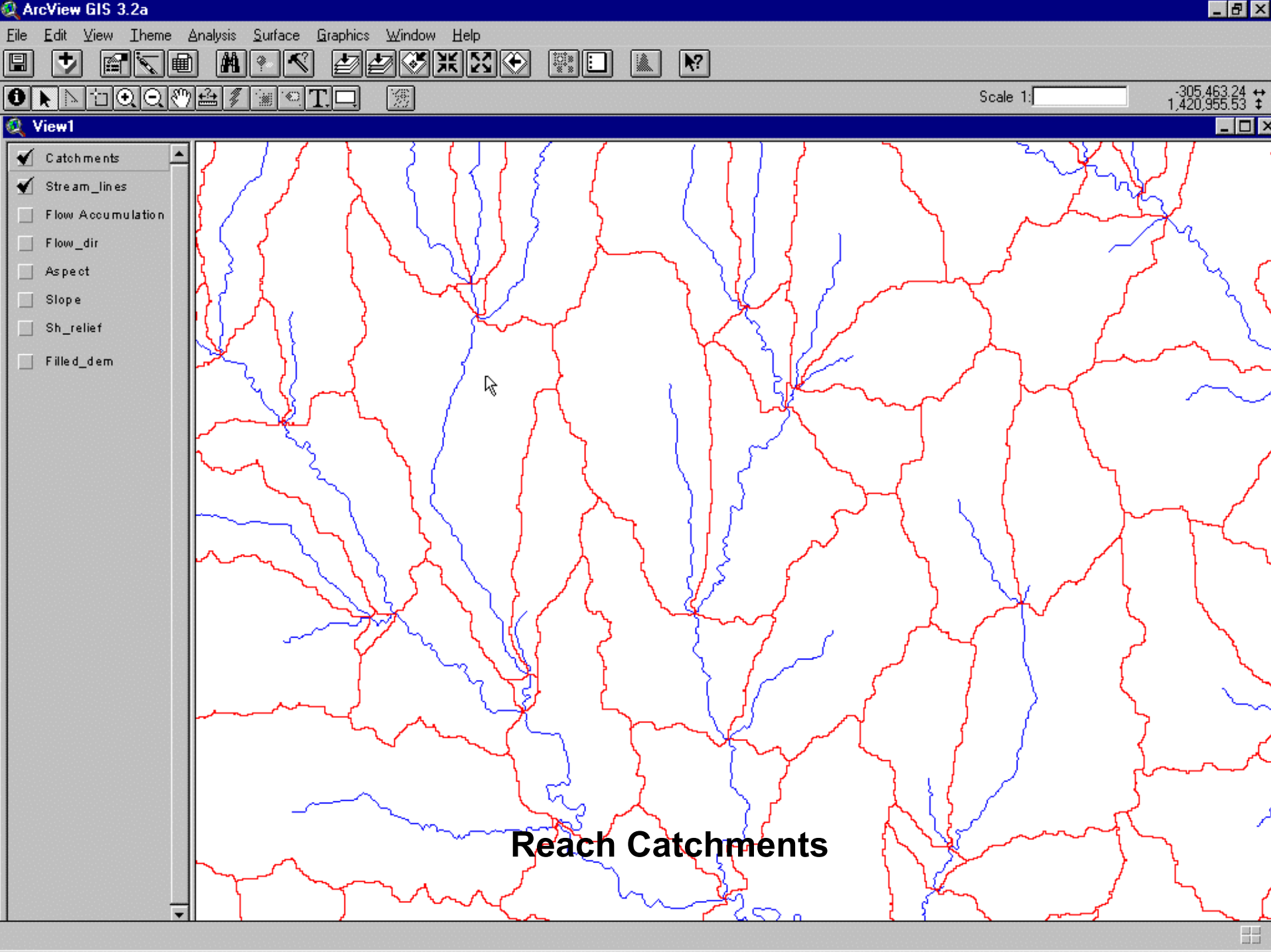
1,419,013.33
View1
Catchments
Stream_lines
Flow Accumulation
Flow_dir
Aspect
Slope
Sh_relief
Filled_dem
Synthetic Streamlines


ArcView GIS 3.2a
File Edit View Theme Analysis Surface Graphics Window Help
Scale 1:
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1,420,955.53
View1
Catchments
Stream_lines
Flow Accumulation
Flow_dir
Aspect
Slope
Sh_relief
Filled_dem
Reach Catchments

Development Stages

- <u>3 Stage Plan for development</u>
  - Stage 1: Blind Pass Processing
    - Cataloging Unit used as processing unit
    - National Weather Service's National Severe Storms Lab in Norman, OK
    - California being done by WRD in Sacramento

Development Stages

- Stage 1 Post-processing
  - Stage 1a: Initial QA/QC of data
  - Stage 1b: Clean-up of sink processing
    - Digital Dam-break algorithm
  - Stage 1c: Attribution of Pfafstetter ID to reach catchments
    - Will immediately be useful as input to AMBER modeling
  - Data are loaded into SDE for browse and potential access to cooperators

Development Stages

- Stage 2: Vector Editing
  - In-depth QA/QC of Stage 1 products by local or regional stakeholders
  - ArcView based procedures for Stage 2 cooperators
  - Output is watershed and subwatershed delineations for WBD along with areas identified for correction in Stage 3

Development Stages

- Stage 3: Raster Editing
  - Tools being developed in ArcView to facilitate DEM edits
  - Collaborative effort with
    - ESRI CRADA
    - EPA ORD
    - HEC
  - Feedback from Stage 2 is incorporated into EDNA DEM via raster edits where required
  - Revised DEM and derivatives reflect correct drainage pattern
  - Derived streamlines are conflated with NHD for final transfer of attributes
    - Reach Code is common attribute

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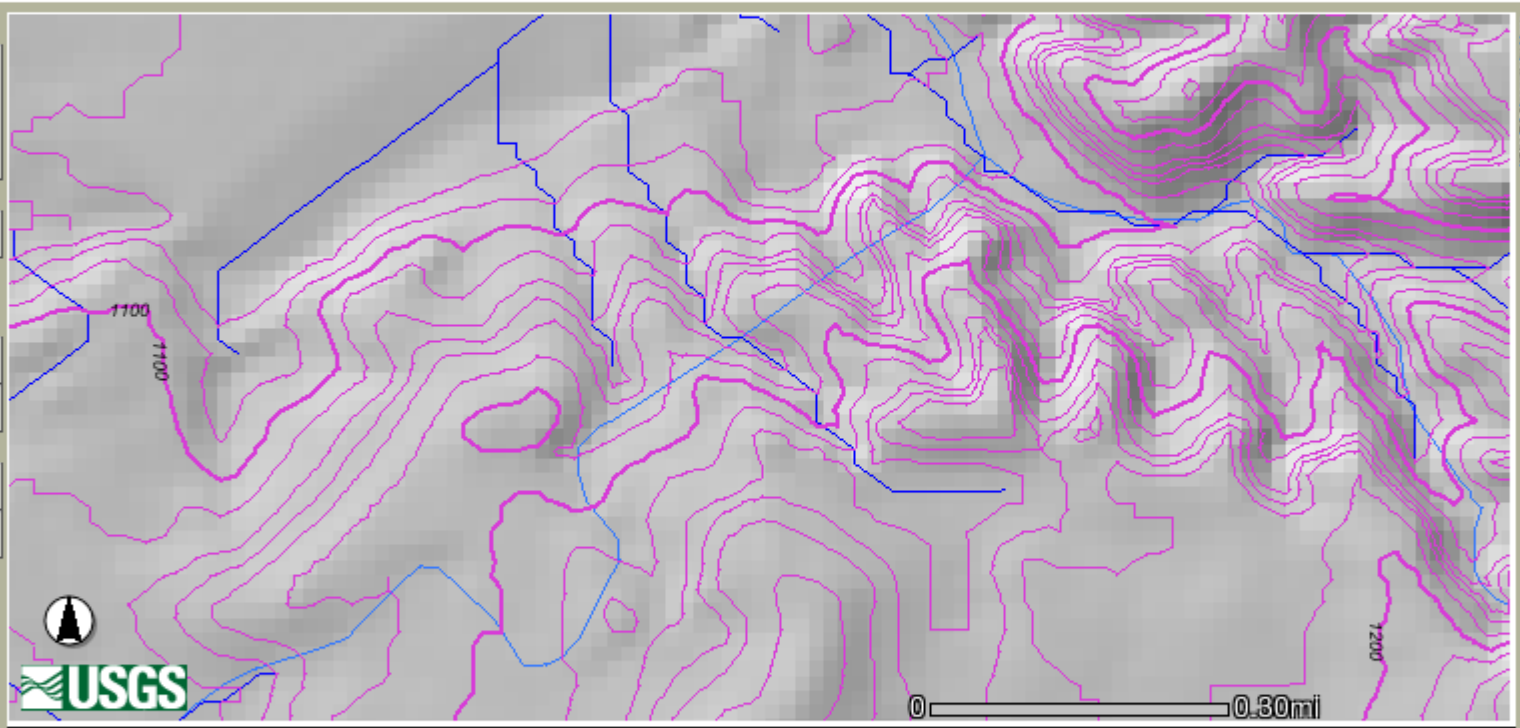
USGS

20 Cities Project - Lincoln, NE



- Map Graphic 24
- Population
- Lincoln_Soils
- Slope
- Lincoln DOQ
- Lincoln DOQ transparent
- Land Cover
- Lincoln_RELIEF_3
- Lincoln_RELIEF_10
- [x] US NED Shaded Relief

Refresh Map

Click on the map to show elevation.

selected = Zoom In

Department of the Interior || U.S. Geological Survey || EROS Data Center

http://edcw2ks35.cr.usgs.gov/Website/lincoln/index.htm || Maintainer: webmapping@usgs.gov || Last Modified: Fri 07 Dec 2001

Map: -96.36 , 41.01 -- Image: 383 , 350 -- ScaleFactor: 0.00003852678724585227

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Bookmarks Location: http://edcw2ks35.cr.usgs.gov/Website/lincoln/viewer.htm What's Rel

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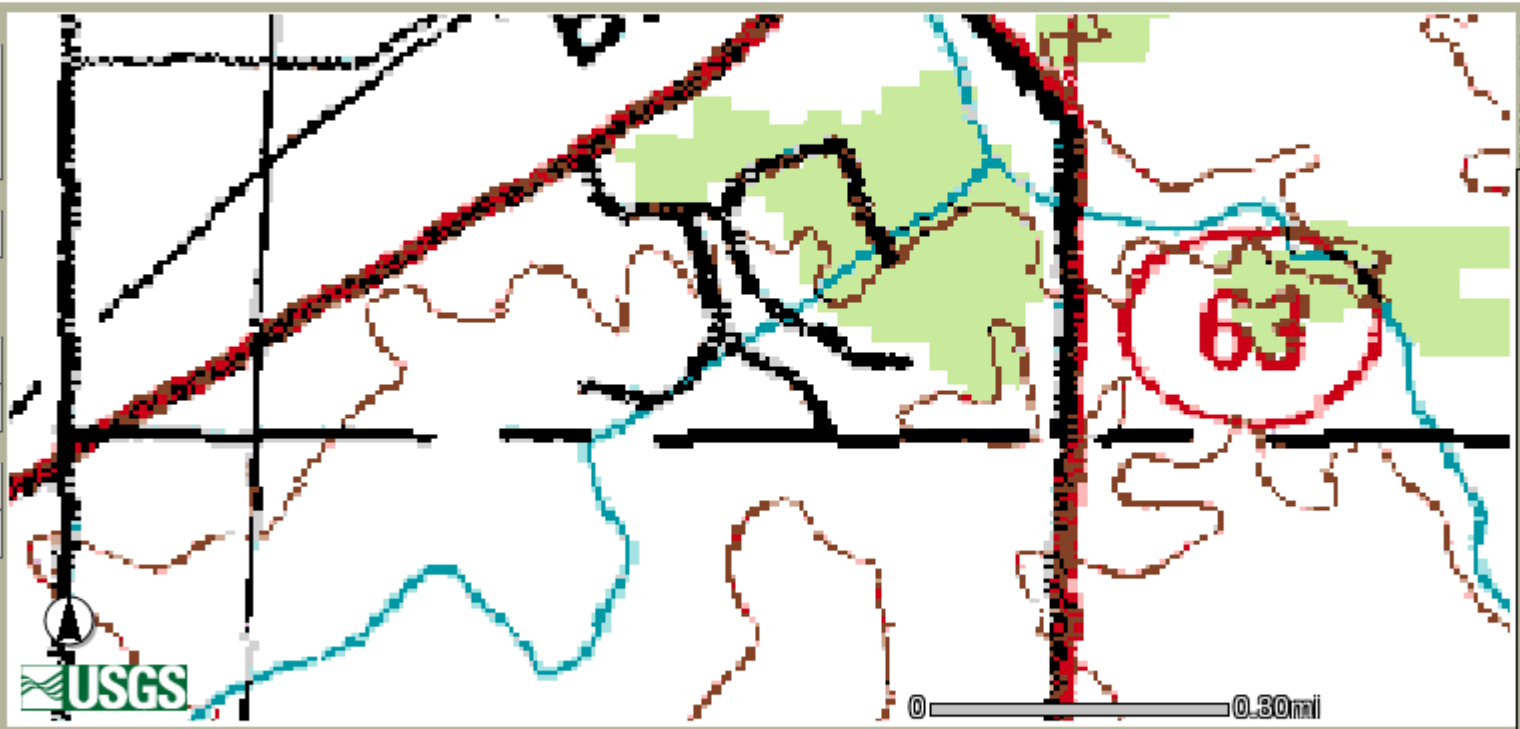

Click on the map to show elevation.

- Map Graphic 100
- Map Graphic 24
- Population
- Lincoln_Soils
- Slope
- Lincoln DOQ
- Lincoln DOQ transparent
- Land Cover
- Lincoln_RELIEF_3
- Lincoln_RELIEF_10
- [x] US NED Shaded Relief

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http://edcw2ks35.cr.usgs.gov/Website/lincoln/index.htm || Maintainer: webmapping@usgs.gov || Last Modified: Fri 07 Dec 2001

Map: -96.36 , 41.01 -- Image: 383 , 350 -- ScaleFactor: 0.00003852678724585227

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Bookmarks Location: http://edcw2ks35.cr.usgs.gov/Website/lincoln/viewer.htm What's Rela

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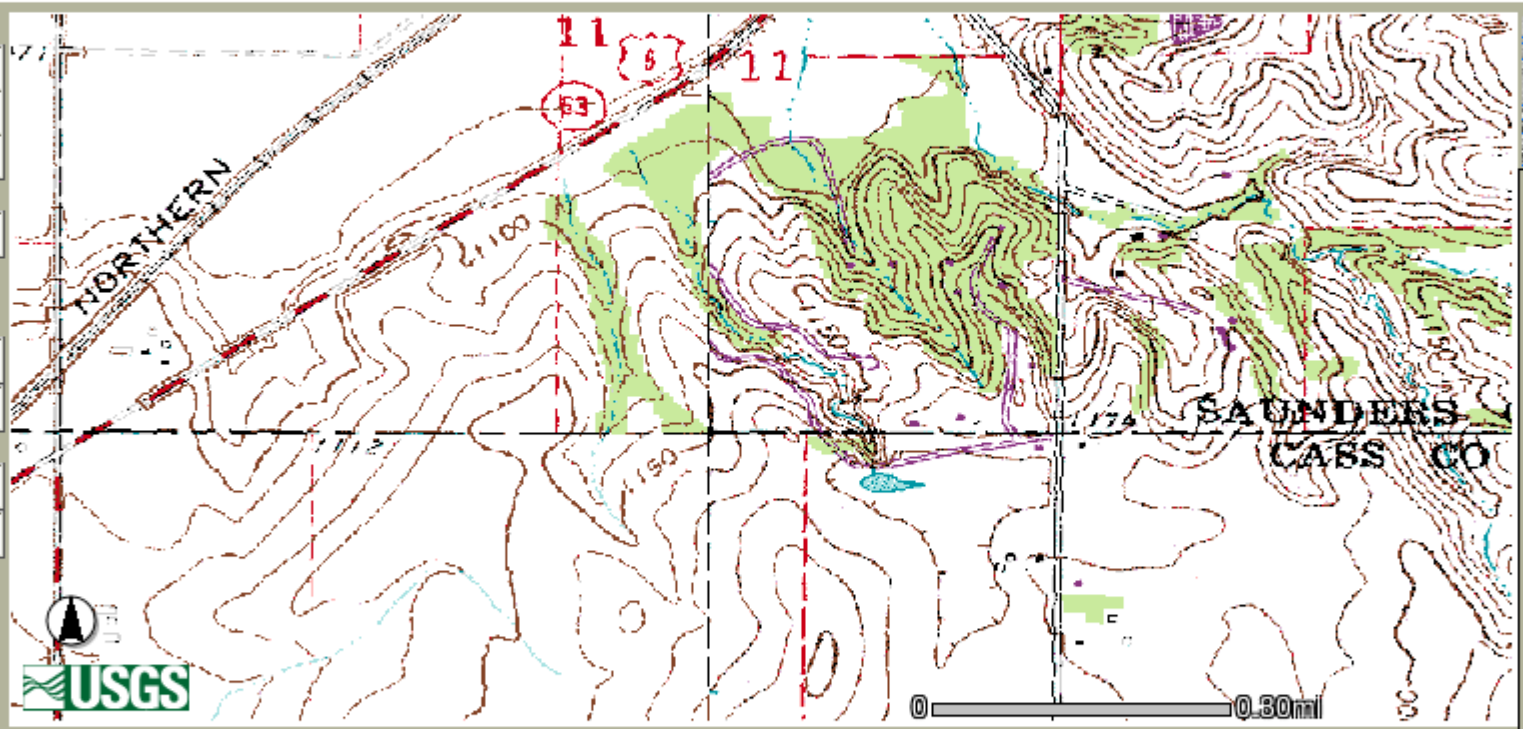

Click on the map to show elevation.

- Map Graphic 100
- ☑ Map Graphic 24
- ☐ Population
- ☐ Lincoln_Soils
- ☐ Slope
- ☐ Lincoln DOQ
- ☐ Lincoln DOQ transparent
- ☐ Land Cover
- ☐ Lincoln_RELIEF_3
- ☐ Lincoln_RELIEF_10
- ☑ US NED Shaded Relief

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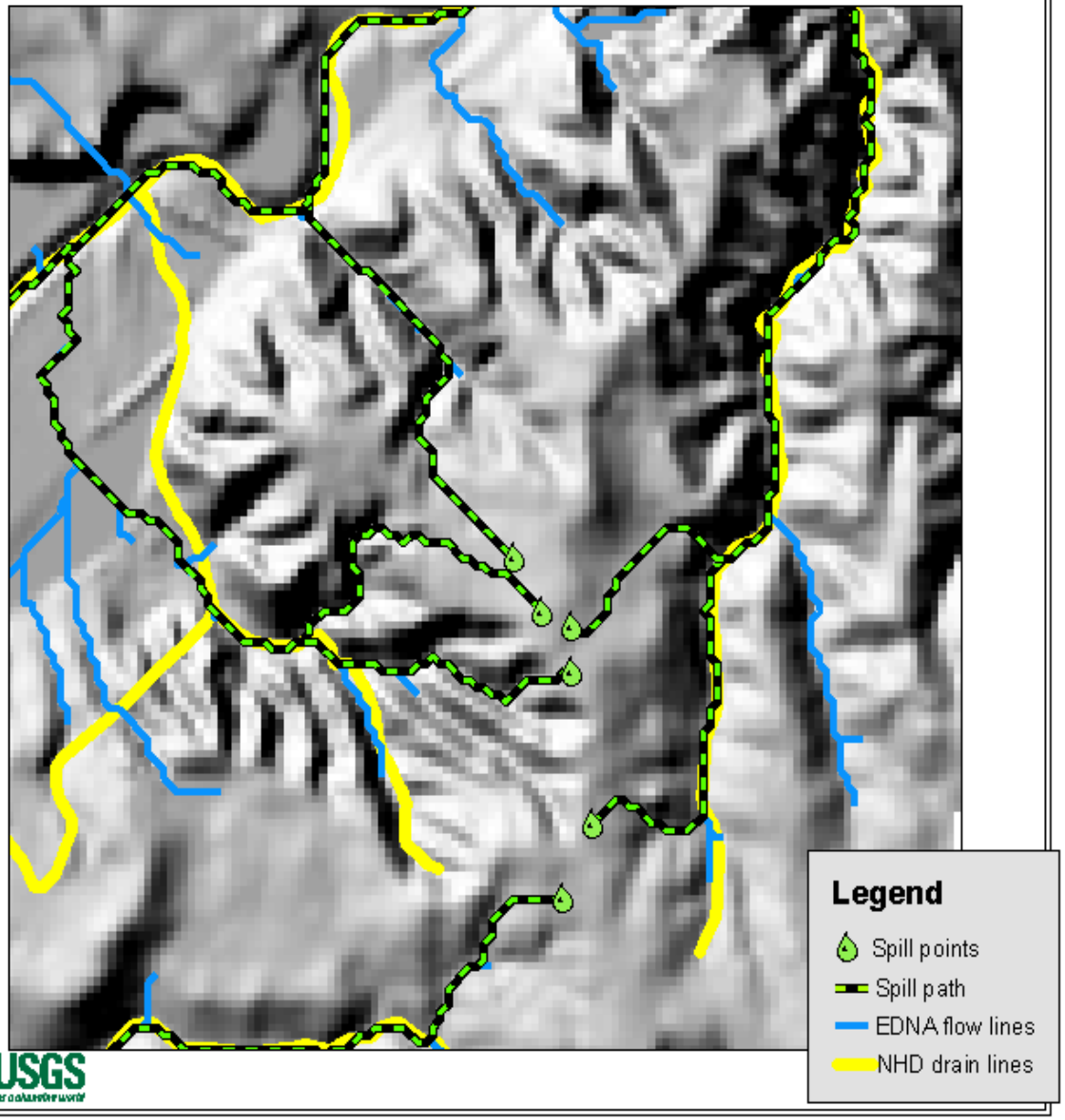
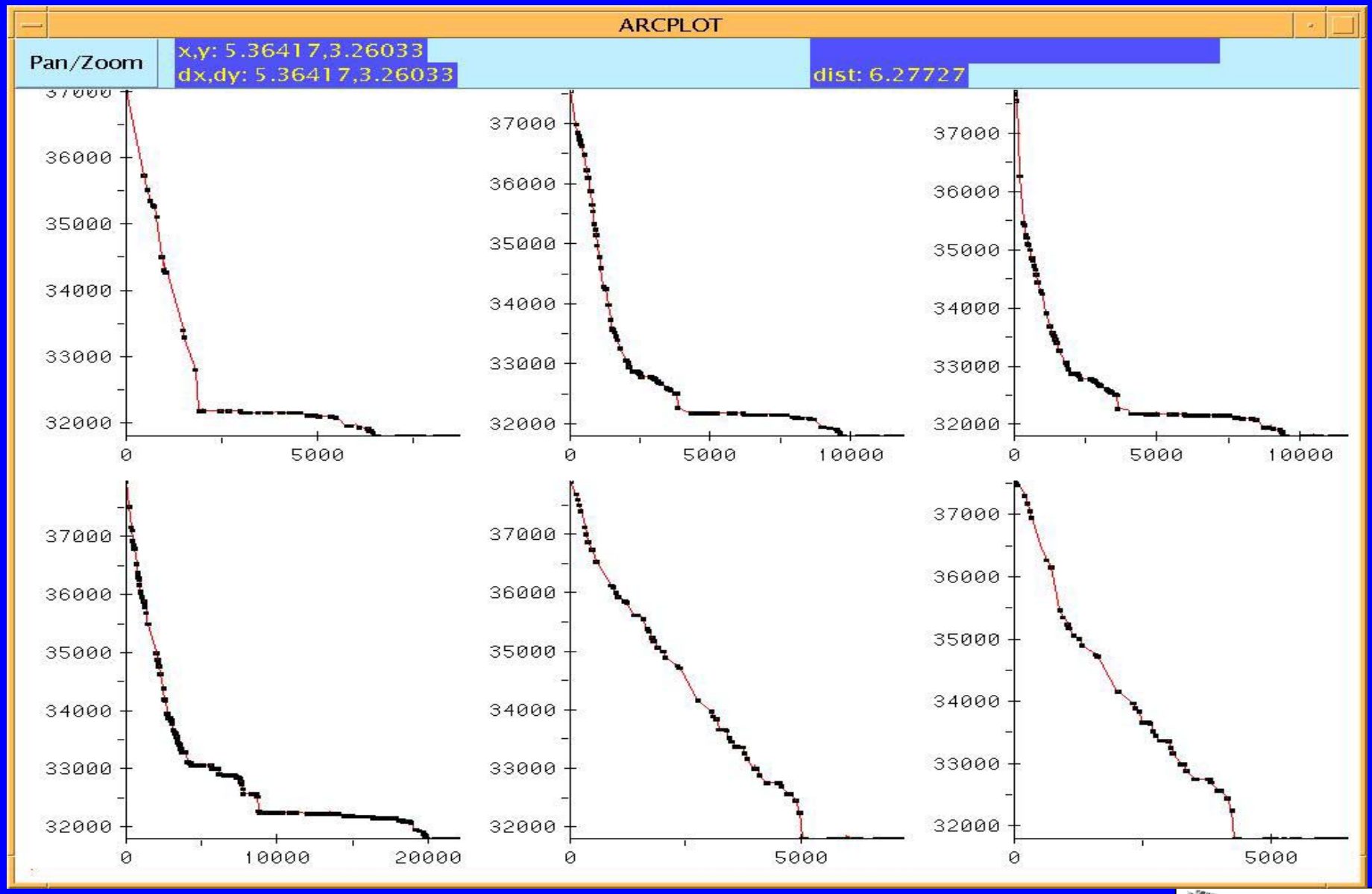
Map: -96.36 , 41.01 -- Image: 383 , 350 -- ScaleFactor: 0.00003852678724585227

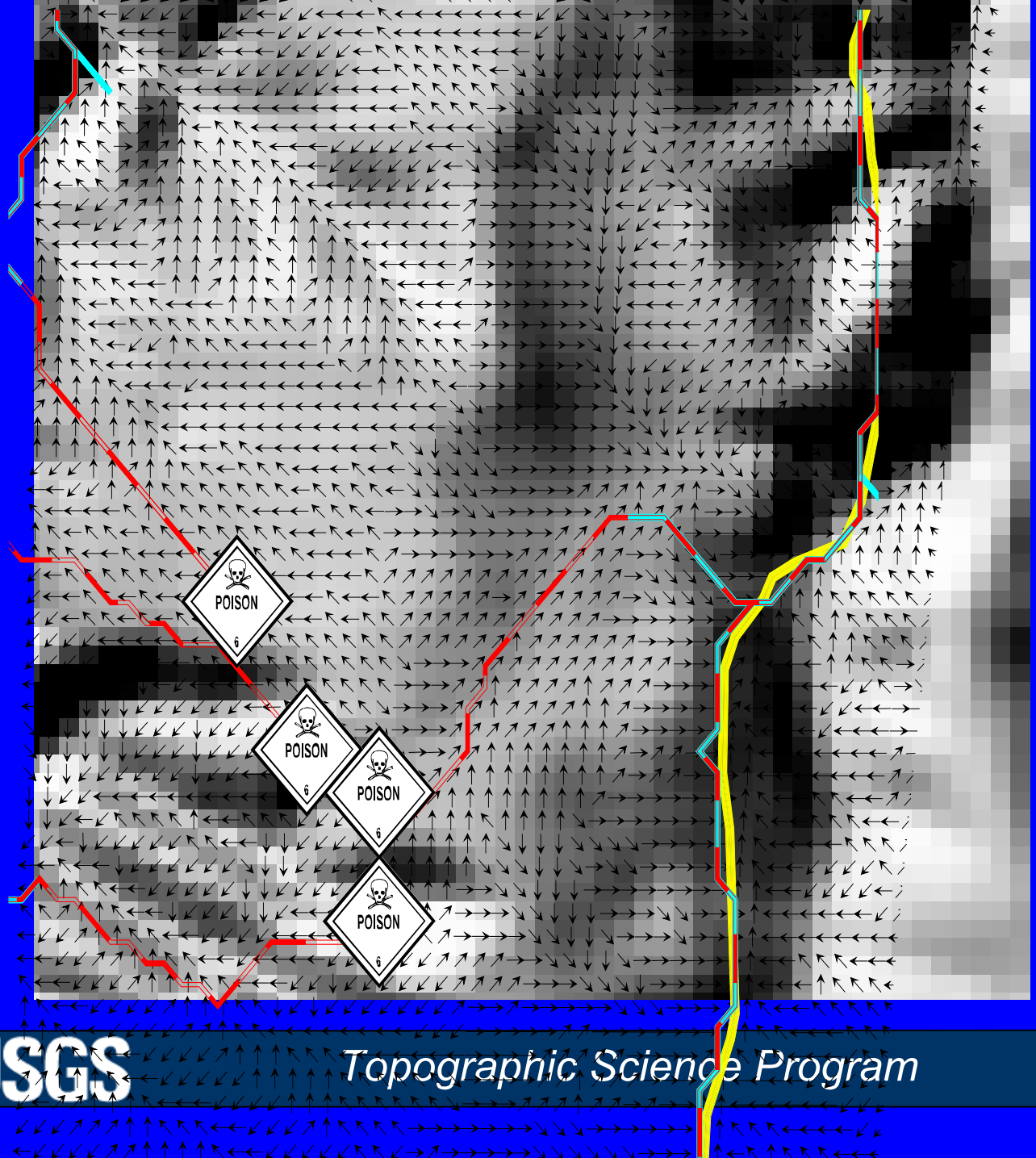
Salt Cataloging Unit (10200203) Spill Paths





USGS

Topographic Science Program



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Topographic Science Program

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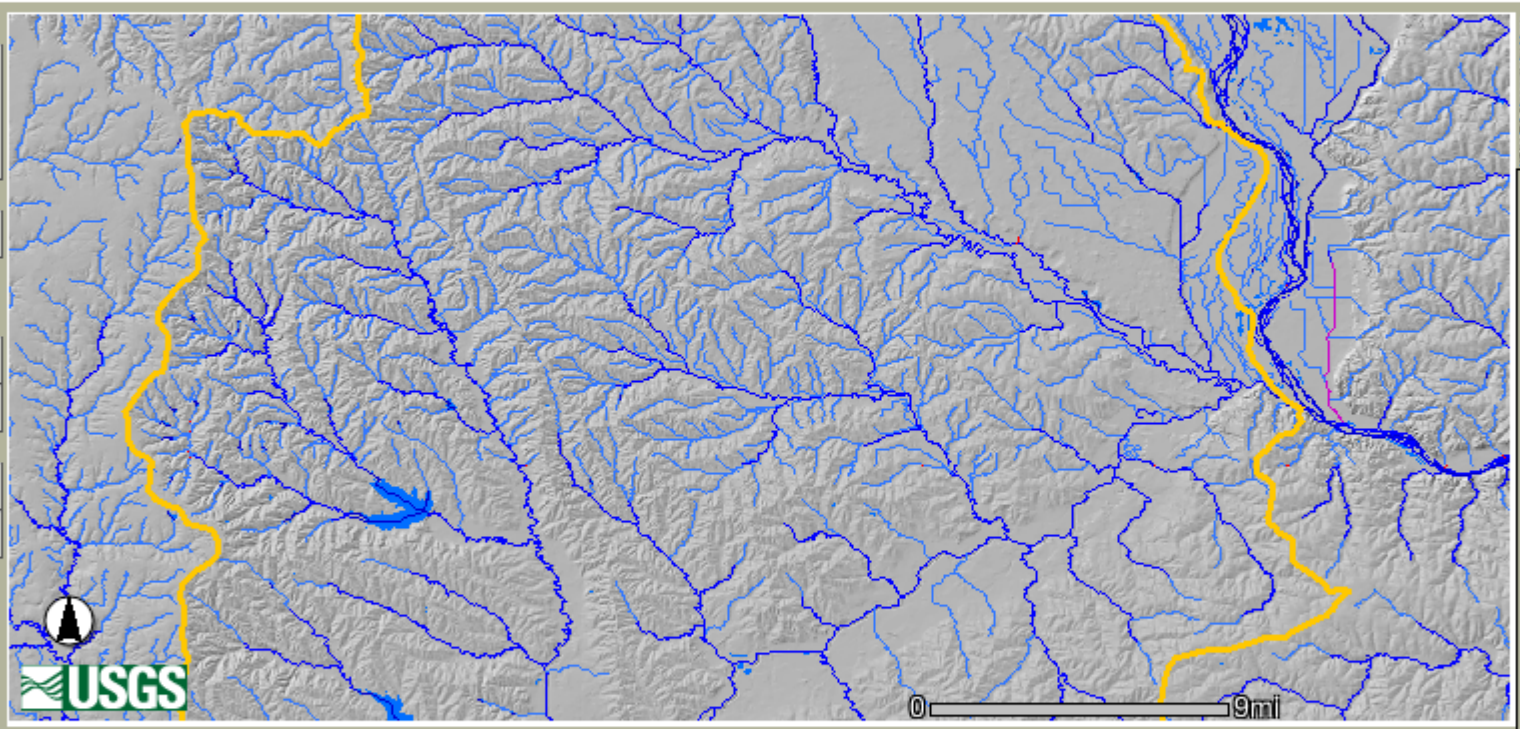

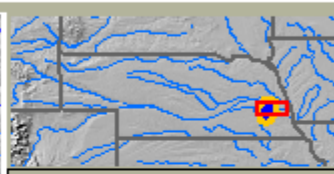

Display Layers

Legend

State Boundaries

Salt Creek Catalog Unit

Mapped Hydrology

Connector

Artificial Path

Canal/Ditch

Pipeline

Stream/River - Intermittent

Stream/River - Perennial

Waterbodies

Playa

Ice Mass

Sea/Ocean

Stream/River - Intermittent

Stream/River - Perennial

Swamp/Marsh

Wash

Salt Creek Catalog Unit is now the Active Layer

selected = Zoom In

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http://edcw2ks35.cr.usgs.gov/Website/lincoln/index.htm || Maintainer: webmapping@usgs.gov || Last Modified: Fri 07 Dec 2001

Map: -96.6 , 40.84 -- Image: 409 , 353 -- ScaleFactor: 0.001237435947867065

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Bookmarks Location: http://edcw2ks35.cr.usgs.gov/Website/lincoln/viewer.htm What's Rela

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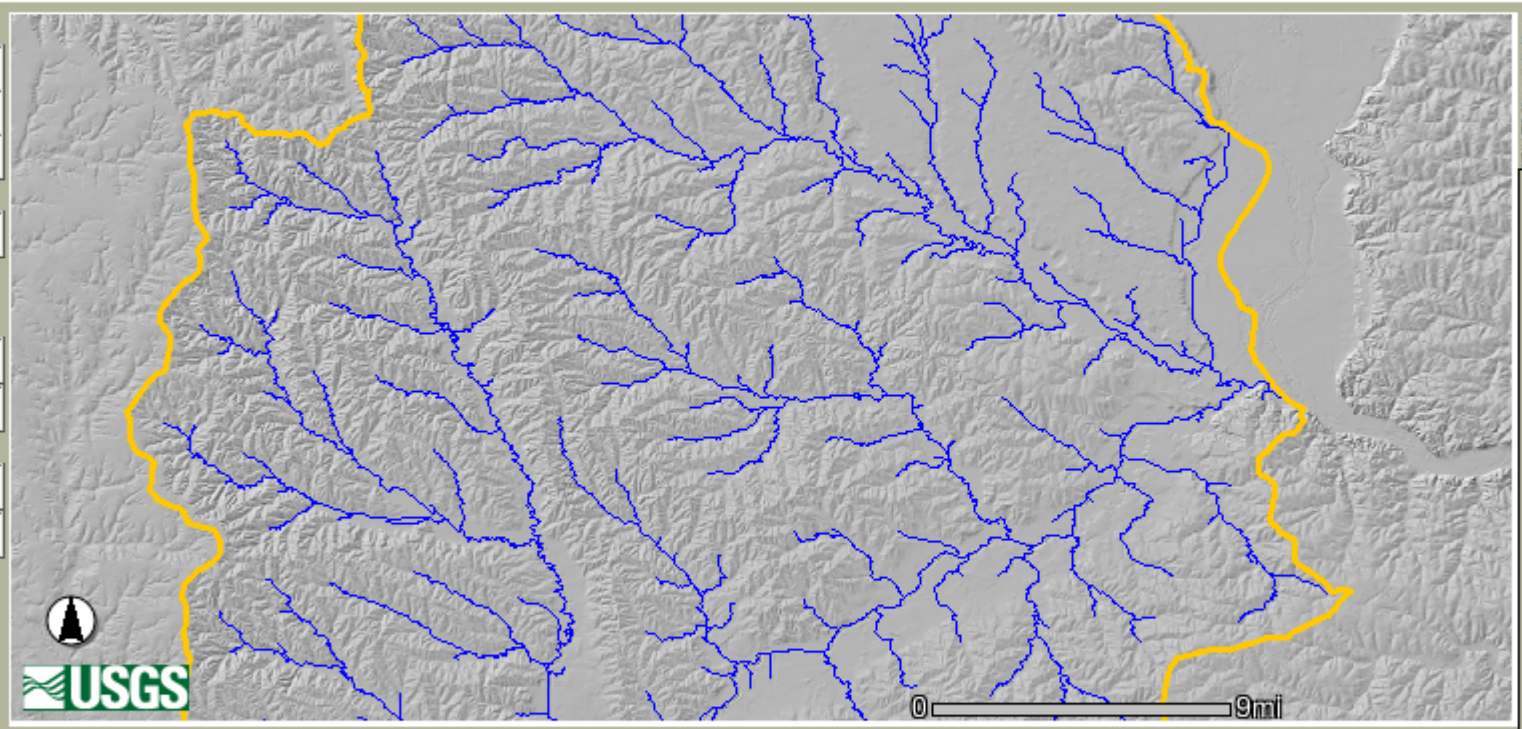

Salt Creek Catalog Unit is now the Active Layer

- ☐ Flow lines at 1000
- ☐ Flow lines at 250
- ☐ Mapped Hydrology
- ☐ Stream Names
- ☐ Waterbodies
- ☐ Catchments
- ☐ Map Graphic 250
- ☐ Population
- ☐ Slope
- ☐ Land Cover
- ☑ US NED Shaded Relief

Refresh Map

selected = Zoom In

Department of the Interior || U.S. Geological Survey || EROS Data Center

http://edcw2ks35.cr.usgs.gov/Website/lincoln/index.htm || Maintainer: webmapping@usgs.gov || Last Modified: Fri 07 Dec 2001

Map: -96.74 , 40.85 -- Image: 291 , 347 -- ScaleFactor: 0.0012374359478670 65

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Bookmarks Location: http://edcw2ks35.cr.usgs.gov/Website/lincoln/viewer.htm What's Rel

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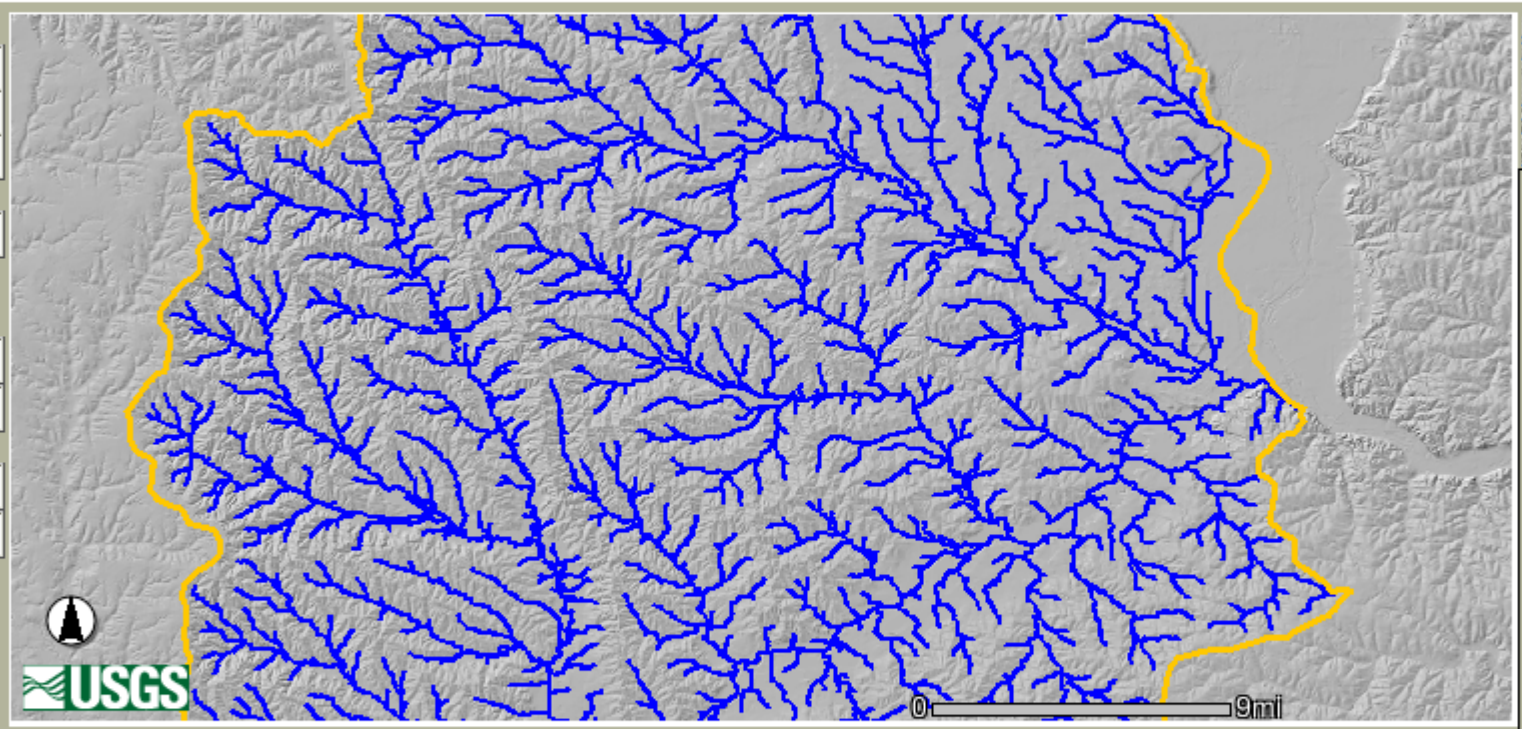

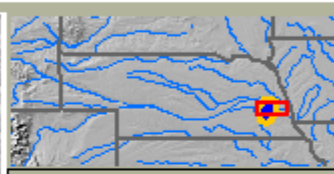

- [ ] Flow lines at 5000
- [x] Flow lines at 1000
- [ ] Flow lines at 250
- [ ] Mapped Hydrology
- [ ] Stream Names
- [ ] Waterbodies
- [ ] Catchments
- [ ] Map Graphic 250
- [ ] Population
- [ ] Slope
- [ ] Land Cover
- [x] US NED Shaded Relief

Refresh Map

Salt Creek Catalog Unit is now the Active Layer

selected = Zoom In

Department of the Interior || U.S. Geological Survey || EROS Data Center

http://edcw2ks35.cr.usgs.gov/Website/lincoln/index.htm || Maintainer: webmapping@usgs.gov || Last Modified: Fri 07 Dec 2001

Map: -96.74 , 40.85 -- Image: 291 , 347 -- ScaleFactor: 0.0012374359478670 65

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Bookmarks Location: http://edcw2ks35.cr.usgs.gov/Website/lincoln/viewer.htm What's Rela

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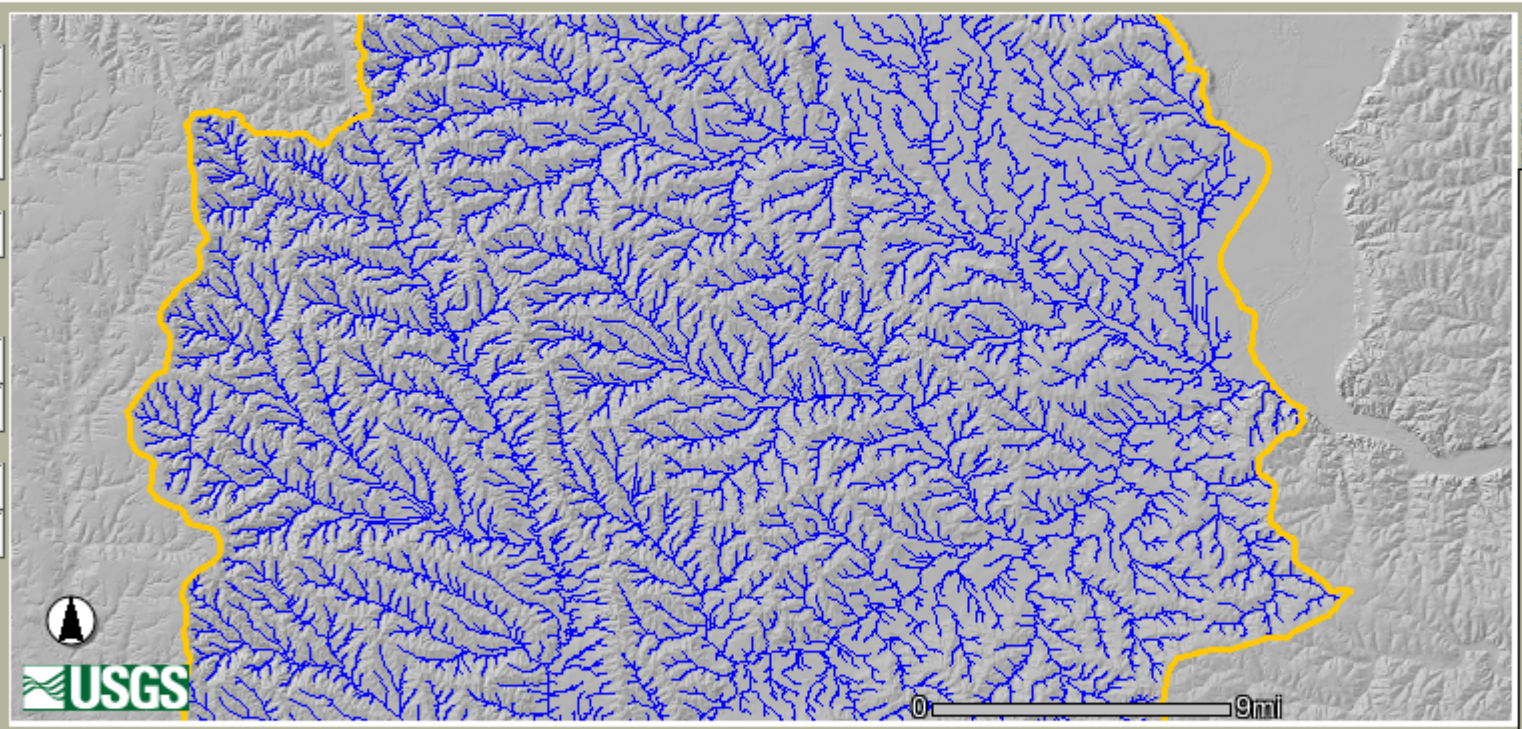
20 Cities Project - Lincoln, NE



Salt Creek Catalog Unit is now the Active Layer

- [ ] Flow lines at 5000
- [ ] Flow lines at 1000
- [x] Flow lines at 250
- [ ] Mapped Hydrology
- [ ] Stream Names
- [ ] Waterbodies
- [ ] Catchments
- [ ] Map Graphic 250
- [ ] Population
- [ ] Slope
- [ ] Land Cover
- [x] US NED Shaded Relief

Refresh Map

selected = Zoom In

Department of the Interior || U.S. Geological Survey || EROS Data Center

http://edcw2ks35.cr.usgs.gov/Website/lincoln/index.htm || Maintainer: webmapping@usgs.gov || Last Modified: Fri 07 Dec 2001

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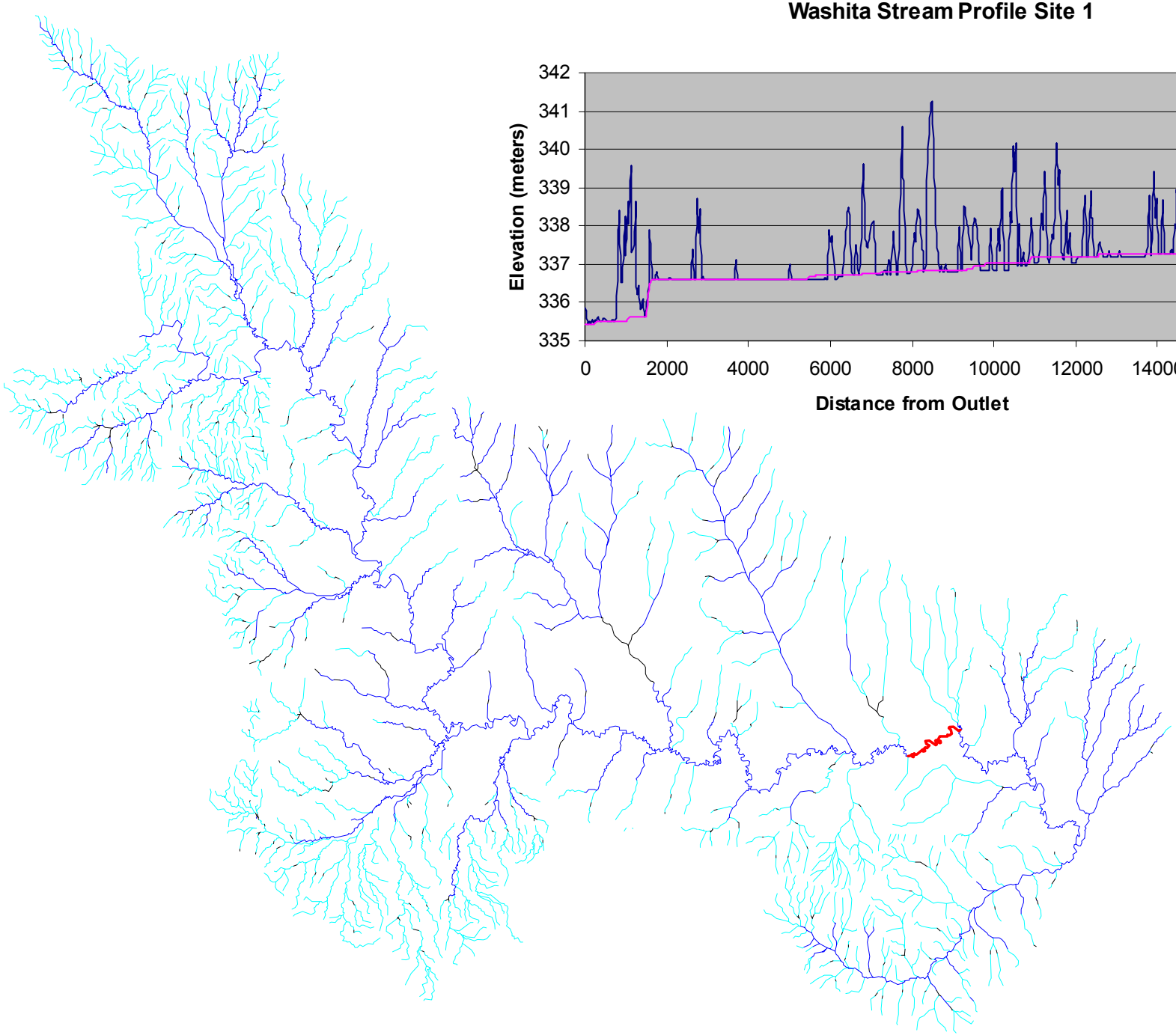

Washita Stream Profile Site 1
Elevation (meters)
342
341
340
339
338
337
336
335
0
2000
4000
6000
8000
10000
12000
14000
16000
Distance from Outlet
NHD
EDNA

Multi-resolution NED & EDNA

	Standard	Medium	High
Cell size	30m	10m	3m
Source	USGS 1:24K map contours and older methods	USGS 1:24K map contours	Hi-res contours Lidar
Coverage	U.S.	30% of U.S.	localized
EDNA application for Lincoln, NE	water supply contamination modelling		In-city contaminant tracking

The National Elevation Dataset

Web site: gisdata.usgs.gov/ned

USGS Web Map - NED Data Source Index - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Search Favorites History

Address http://gisdata.usgs.net/website/USGS_GN_NED_DSI/viewer.htm Go Links

USGS

USGS Web Map - NED Data Source Index

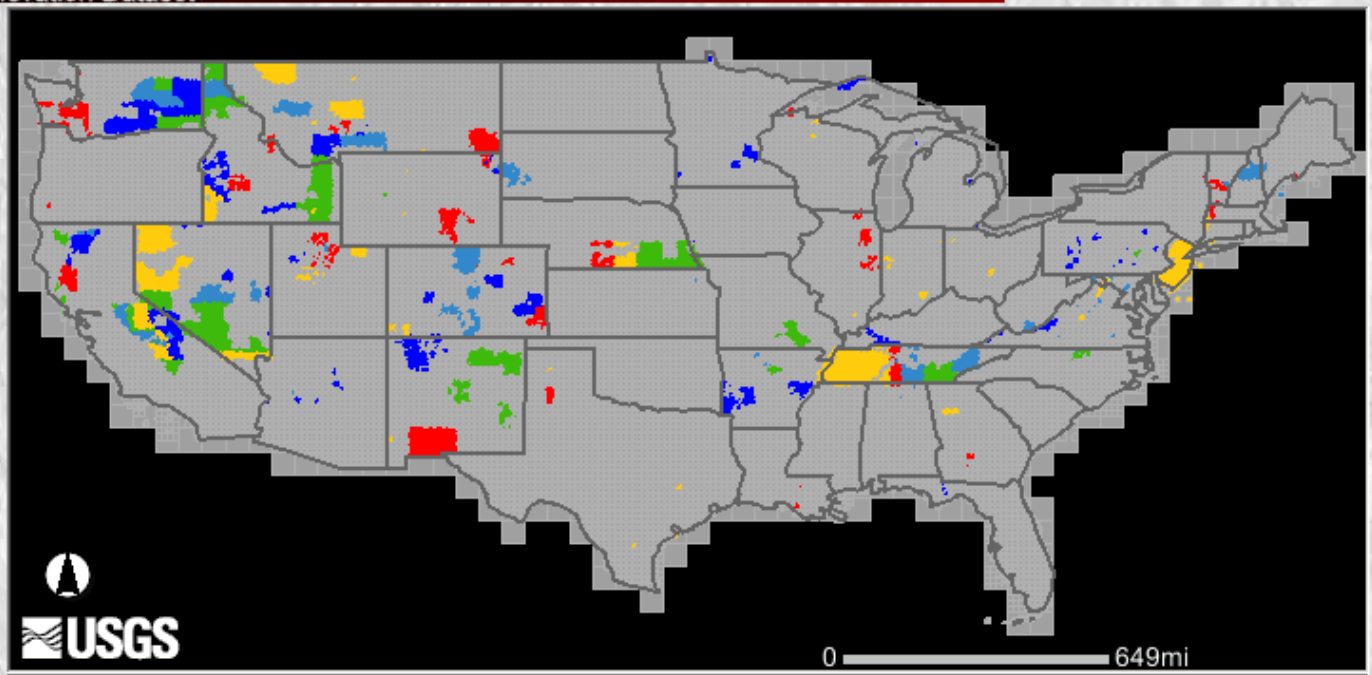
National Elevation Dataset

Move

Zoom

Select

Misc



Order NED
NED Docs

Display Layers

Legend
States-15M
Date_of_Update
Before Dec., 2000
Feb., 2001
Apr., 2001
Jun., 2001
Aug., 2001
Oct., 2001
Other

Date_of_Update is now the Active Layer

Tool selected = Zoom In

National Elevation Dataset

U.S. Department of the Interior || U.S. Geological Survey || EROS Data Center

URL: http://gisdata.usgs.net/website/USGS_GN_NED_DSI/index.htm || Maintainer: webmapping@usgs.gov || Last Modified: Thu 02 Aug 2001

Toggle between Legend and LayerList

Internet

USGS Web Map - NED Data Source Index - Microsoft Internet Explorer

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Address http://gisdata.usgs.net/website/USGS_GN_NED_DSI/viewer.htm Go Links

USGS

USGS Web Map - NED Data Source Index

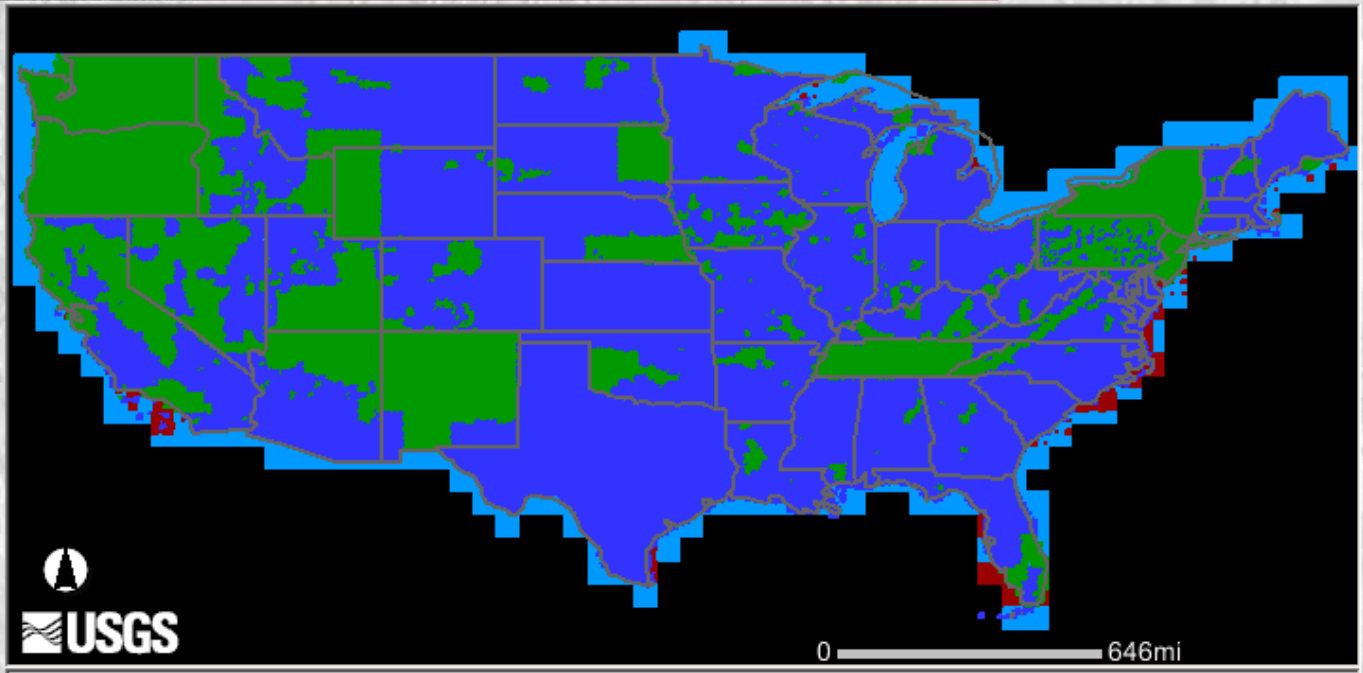
National Elevation Dataset

Move

Zoom

Select

Misc



Order NED
NED Docs

Display Layers

Legend
States-15M
Resolution
10 meter
30 meter
2 arc second
3 arc second

Resolution is now the Active Layer

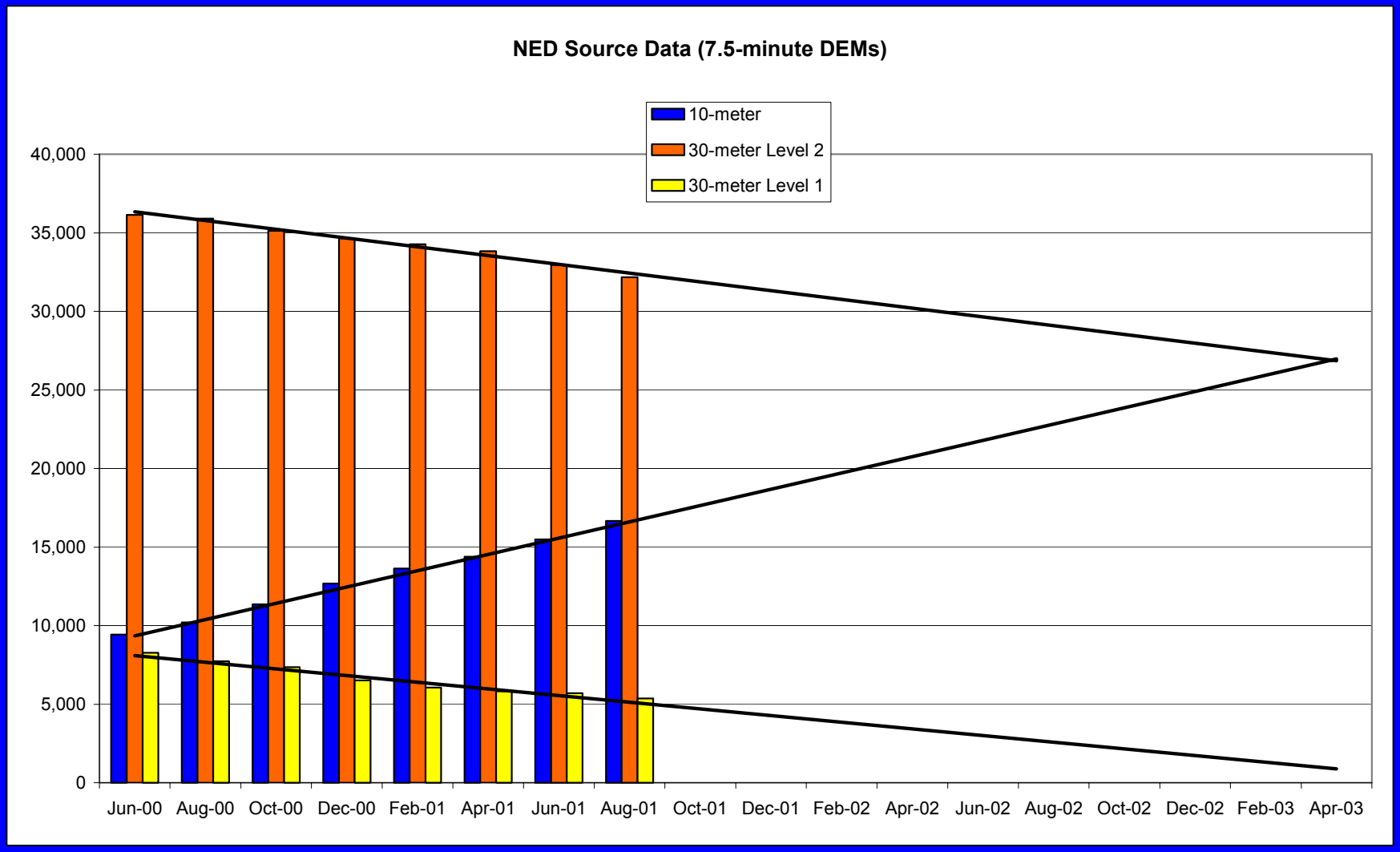
Tool selected = Zoom In

National Elevation Dataset

U.S. Department of the Interior || U.S. Geological Survey || EROS Data Center

URL: http://gisdata.usgs.net/website/USGS_GN_NED_DSI/index.htm || Maintainer: webmapping@usgs.gov || Last Modified: Thu 02 Aug 2001

Map: -67.62 , 22.58 -- Image: 701 , 346 -- ScaleFactor: 0.08221390368020055 Internet

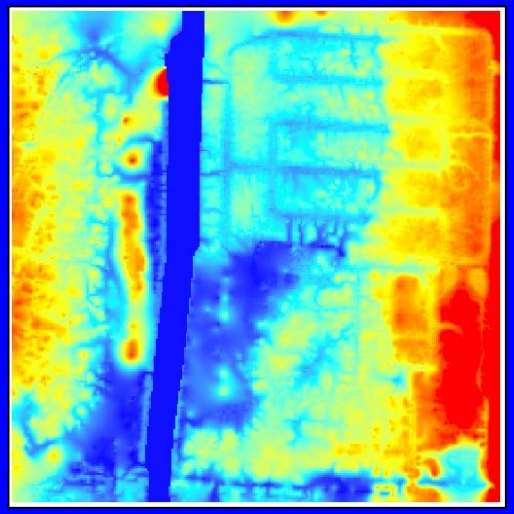

NED Source Data (7.5-minute DEMs)
10-meter
30-meter Level 2
30-meter Level 1
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Jun-00
Aug-00
Oct-00
Dec-00
Feb-01
Apr-01
Jun-01
Aug-01
Oct-01
Dec-01
Feb-02
Apr-02
Jun-02
Aug-02
Oct-02
Dec-02
Feb-03
Apr-03

1 arc-second

1/3 arc-second

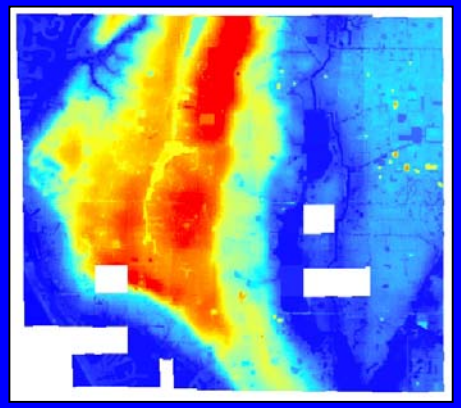
Quarter section processing

Lidar points



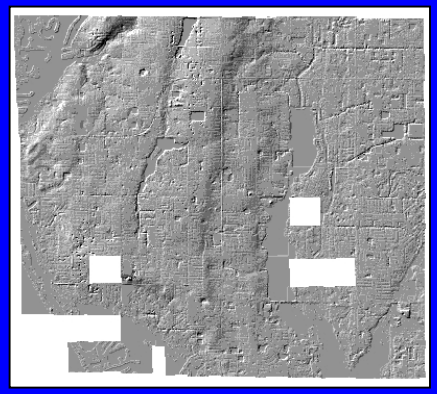
Lidar grid

DOQ & DLG



Township mosaic

1/9-arc-second



High-resolution, non-standard data

- NASA-NOAA-USGS Coastal Lidar

USGS - Coastal and Nearshore Mapping with Scanning Airborne Laser (Lidar) - Microsoft Internet Explorer

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Address http://coastal.er.usgs.gov/lidar/ Go Links

USGS science for a changing world NASA NOAA

Center for Coastal Geology

Hurricane and Extreme Storm Impact Studies

Coastal and Nearshore Mapping with Scanning Airborne Laser (Lidar)

Hurricane & Extreme Storm Impacts Home

Scanning Airborne Laser Altimetry

Coastal Change Mapping:

Hurricane Dennis - 1999

Hurricane Bonnie - 1998

1997-98 El-Niño

Contact: Abby Sallenger

In a cooperative research program, USGS, NASA and NOAA acquire laser altimetry data prior to and following extreme storms to quantify amounts of coastal change using NASA's Airborne Topographic Mapper (ATM). The ATM was developed for climate change applications involving annual surveys of the Greenland ice sheet, but is also ideal for surveying the topography of beaches. The ATM can survey hundreds of kilometers of coast in a single day with data densities that cannot be achieved with traditional survey technologies.

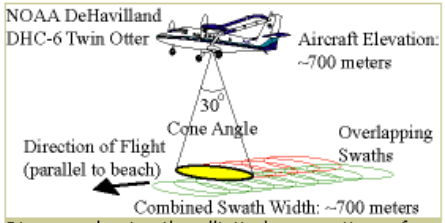


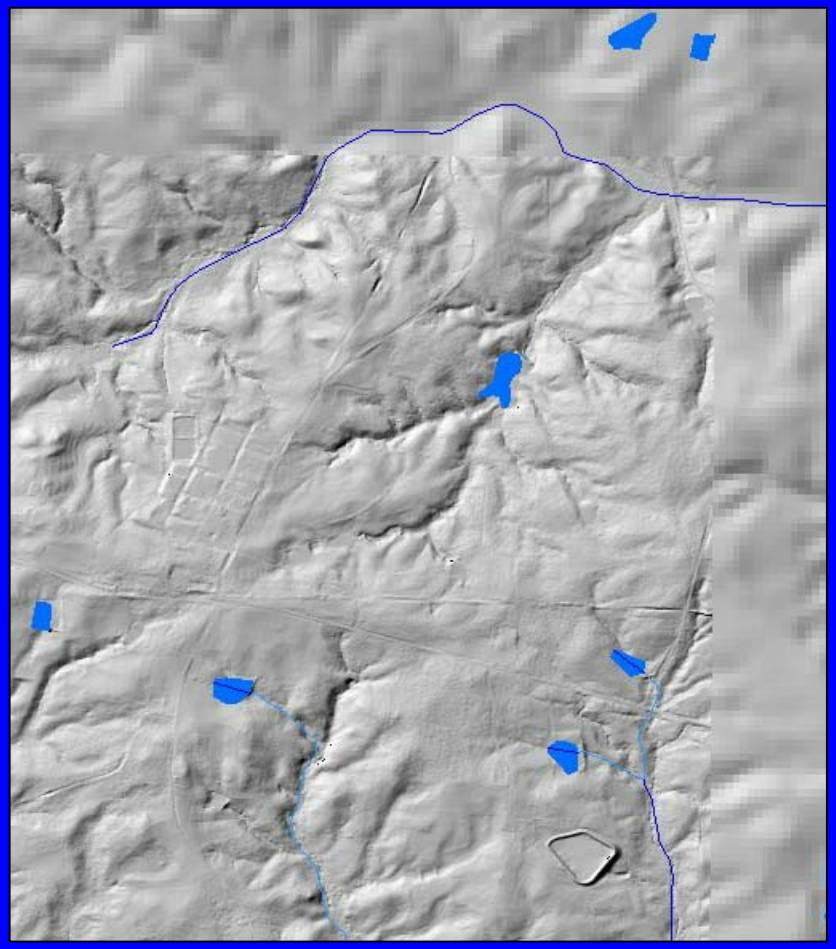
Diagram showing the elliptical scan pattern of NASA's Airborne Topographic Mapper operated from a NOAA Twin Otter.

As the aircraft flies along the coast, a laser altimeter scans a several hundred meter swath of the earth's surface acquiring an estimate of ground elevation every few square meters. Change is quantified by comparing pre-storm to post-storm surveys. Traditional USGS topographic sheets do not have sufficient resolution to be useful for comparing coastal elevations. Airborne scanning laser surveys are providing unprecedented data to investigate the magnitude and causes of coastal changes that occur during severe storms.

Internet

High-resolution, non-standard data

- North Carolina Lidar
  - 5 m and 50 ft bare earth DEMs (50 ft hydro enforced with DOQ-derived breaklines)
  - Use breaklines to enforce 5 m DEM?



National Digital Elevation Program (NDEP)

- A consortium of Federal agencies formed to leverage resources to satisfy multiple requirements for elevation data:
  - Enhance data sharing among Federal, state, and local agencies, the private sector, and academia
  - Minimize redundant data production
  - Develop flexible standards for use by all
  - Assure accessibility of “best available” digital topographic data

National Digital Elevation Program

BLM

FEMA

NASA

NIMA

NOAA

N·D·E·P
National Digital Elevation Program

NSGIC

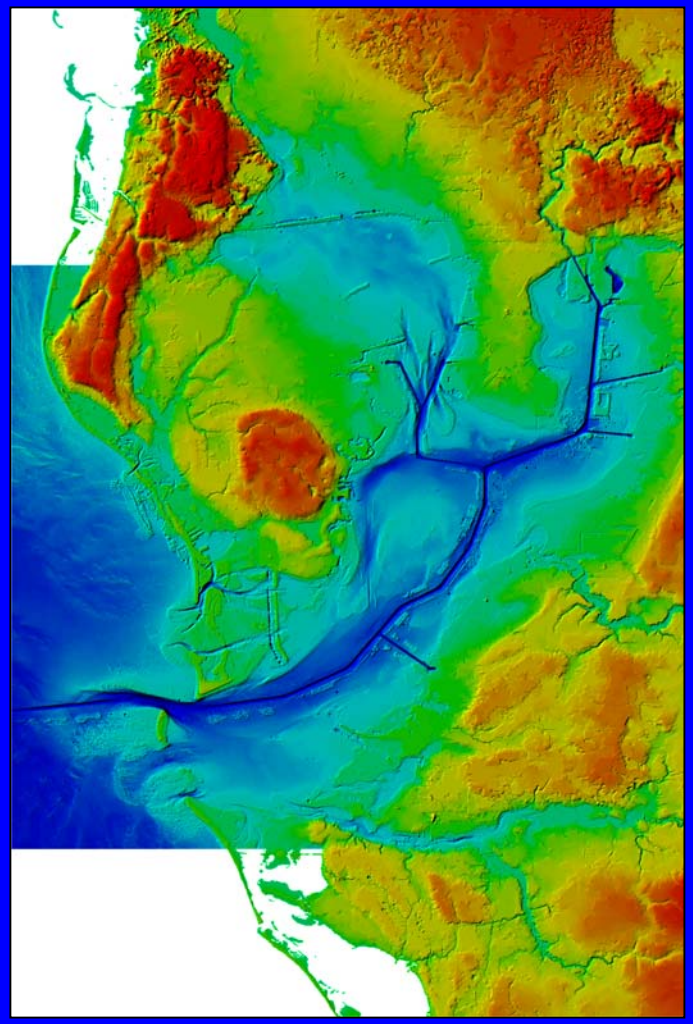
NRCS

USACE

USFS

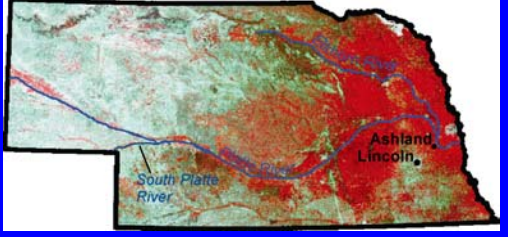
USGS

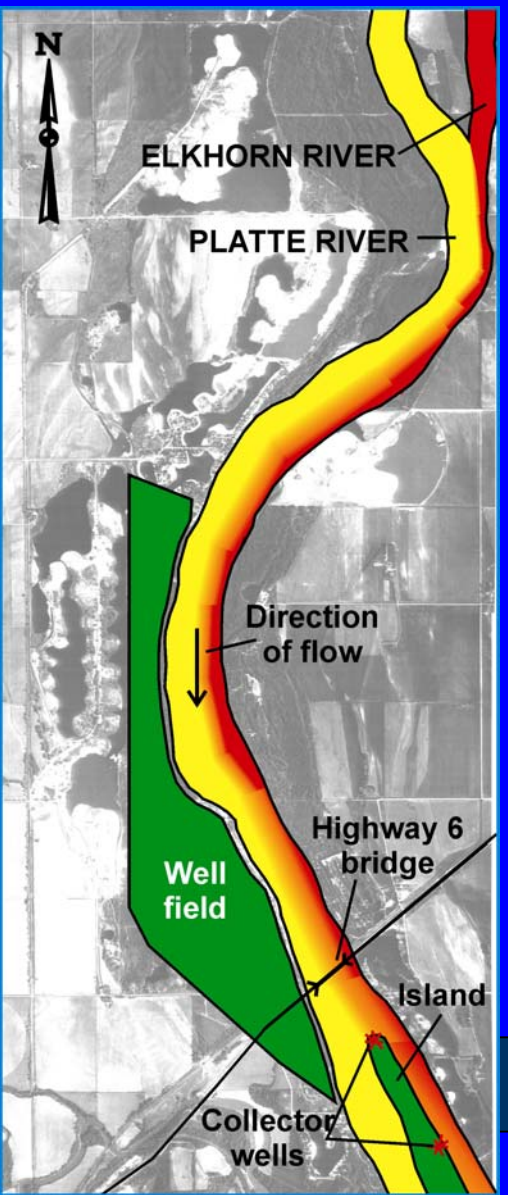
Topo/bathy integration

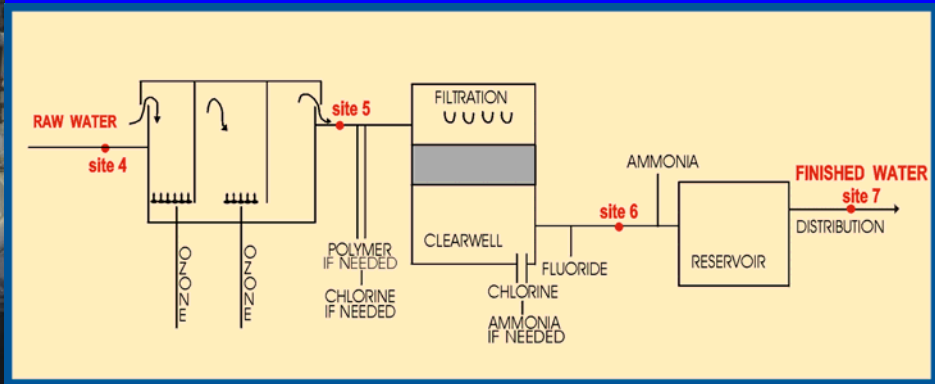


- Tampa Bay 10-m and 30-m merges delivered for use in integrated science pilot for Gulf coast estuaries

Horizontal Wells







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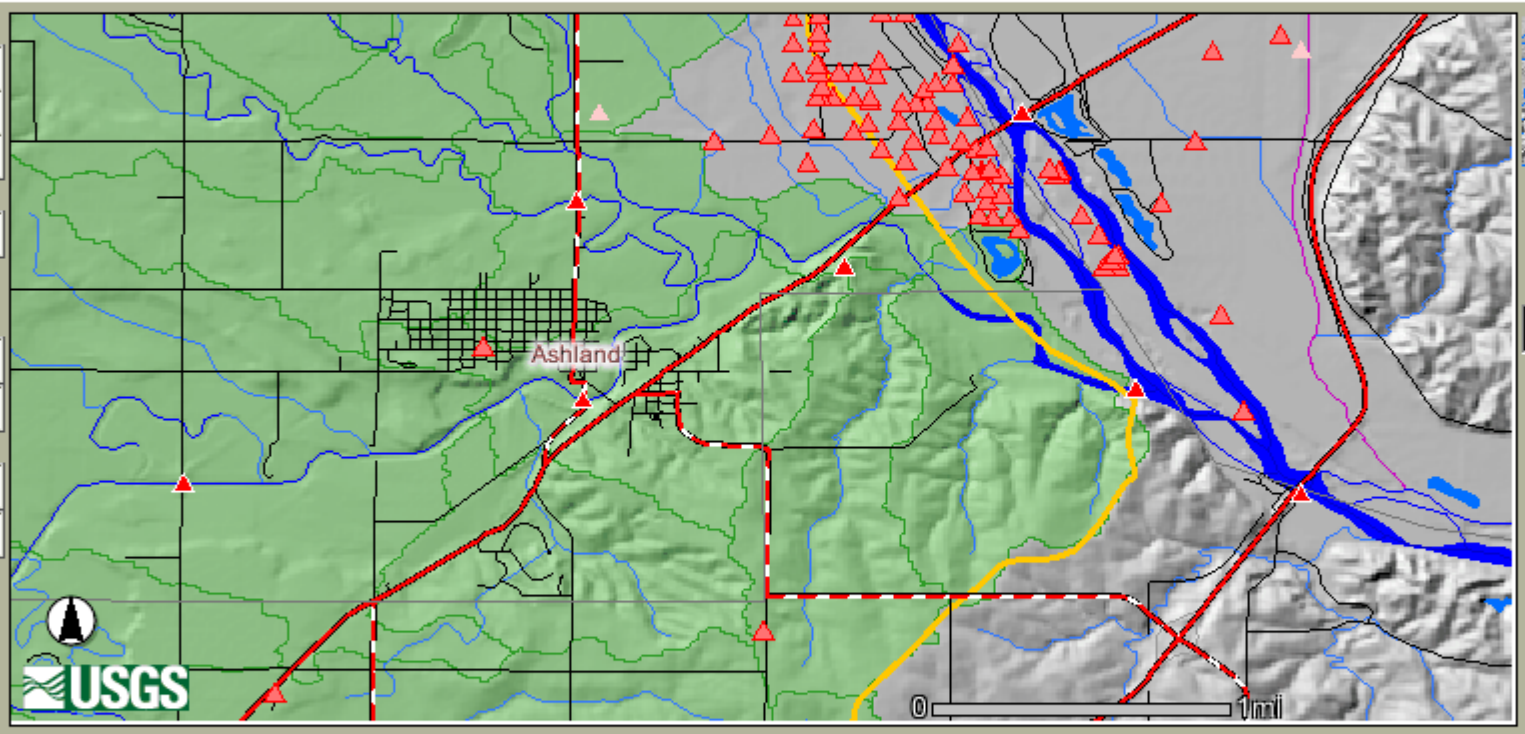
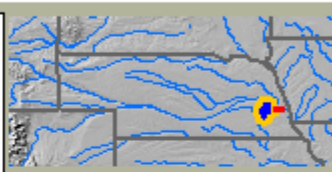
USGS

20 Cities Project - Lincoln, NE





Display Legend

Current Active Layer:

Water Info Points

Layers

Visible

- [x] Cities and Towns
- [ ] Other Names
- [x] Water Info Points
- [ ] contour100
- [ ] contours50
- [ ] contours25
- [ ] contours10
- [ ] County Labels
- [x] Country Boundaries

Water Info Points

No Features found.

selected = Select Rectangle

Department of the Interior || U.S. Geological Survey || EROS Data Center

http://edcw2ks35.cr.usgs.gov/Website/lincoln/index.htm || Maintainer: webmapping@usgs.gov || Last Modified: Fri 07 Dec 2001

Map: -96.32 , 41.05 -- Image: 502 , 135 -- ScaleFactor: 0.00019498122275865627