May 18, 2018

MEMORANDUM

To: Brian Hunt

From: Tom Grimshaw

Subject: LIDAR Mapping of the Mountain City Quadrangle

During the early stages of our geologic mapping project for the Mountain City Quadrangle, an attempt was made to use LIDAR images to supplement our photogeologic mapping. The hope was that LIDAR would be more effective than aerial photographs in detecting surface expression of faults in the Edwards strata.

The effort was led by Dr. Mark Helper of the University of Texas Department of Geological Sciences. Dr. Helper used LIDAR image files that I obtained from the Texas Natural Resource Information System. The initial step, as I recall, was a "shaded image" map of the quadrangle. Dr. Helper then prepared a LIDAR-based slope map, which was analyzed for Edwards faults with the help of student assistant Marissa (last name not recorded). The analysis of the slope map was also depicted on a digital orthophoto map.

Subsequently, Dr. Helper and another student assistant, Ian Yeats, did a similar analysis on an area west of the Mountain City Quadrangle. This area is underlain by limestones of the Upper Glen Rose formation. The work by Yeats was published as an abstract in the Proceedings of the Geological Society of America Annual Meeting in November 2015.

The mapping and results are shown (with file names in paretheses) in the following Attachments to this memo:

A. Yeats, et al, 2015, Application of Airborne LIDAR to Geologic Mapping in Central Texas
B. Marissa Mapping on LIDAR Slope Map (MtCity_w_Marissa_lines_on_slopemap.pdf)
C. Marissa Mapping on LIDAR Digital Orthophoto Quadrangle[1] (MountainCity_w_Marissa_lines_on_DOQ.pdf)
D. LIDAR Shade Map (MountainCityLIDAR_hsade.pdf)

Overall, LIDAR images proved to be much more useful in the area west of the Mountain City Quadrangle, where the subsurface is underlain by the Upper Glen Rose formation These strata have a surface expression consisting of the stair-step (terraced) topography that is amenable to LIDAR interpretation.

Areas underlain by the comparatively featureless surfaces of the Edwards strata of the Mountain City Quadrangle were much less amenable to LIDAR analysis. Within the Quadrangle, Marissa and Dr. Helper were able to map several faults, as shown in Attachment B. Although the fault locations approximate the faults found on air photos, the LIDAR mapping did not prove to be as great an improvement over the photogeology method as hoped.

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[1] Because of printer problems, only the first three sheets of the DOQ are included in Attachment C.

Attachment A.

Yeats, et al, 2015, Application of Airborne LIDAR to Geologic Mapping in Central Texas

2015 GSA Annual Meeting in Baltimore, Maryland, USA (1-4 November 2015)

Paper No. 5-13
Presentation Time: 11:15 AM

APPLICATION OF AIRBORNE LIDAR TO GEOLOGIC MAPPING IN CENTRAL TEXAS

YEATS, Ian[1], HELPER, Mark[1] and HUNT, Brian B.[2], (1)Jackson School of Geosciences, The University of Texas at Austin, 1 University Station C11001, Austin, TX 78712, (2)Barton Springs/Edwards Aquifer Conservation District, 1124 Regal Row, Austin, TX 78748, yeatsi116@gmail.com

Field mapping in the Central Texas region encounters several major problems including limited access to private land, limited outcrop, dense and variable vegetative cover, and indistinguishable carbonate facies. Airborne LiDAR data can be a useful tool in overcoming some of these obstacles. The data can be processed in Geographic Information Systems (GIS) to generate a Digital Elevation Model (DEM), effectively creating a bare-earth model of the land surface, which can be further processed into derivative products such as slope raster maps. LiDAR data was acquired from the Texas Natural Resources Information System (TNRIS) for the Driftwood, Mountain City, and Signal Hill quadrangles in Central Texas and used to generate a 2.1 meter resolution DEM. The Cretaceous units in Central Texas feature prominent tread-and-riser geometries in their bedding, which are best displayed in GIS as a slope raster generated from the DEM. The slope raster map, which displays the slope of the landscape at each raster cell, was calibrated and correlated to a measured section from the field area demonstrating it can resolve riser beds down to the sub-foot scale. Distinct and continuous patterns on the slope raster map delineate treads and risers of the contacts between the Glen Rose Fm., Walnut Fm., and Edwards Group, which can be mapped directly in GIS. Breaks in these patterns represent mappable faults. These patterns generated from LiDAR are not apparent in other elevation data sets (topographic maps, National Elevation Dataset, Shuttle Radar Topography Mission) and more traditional remote mapping techniques, such as stereo photo pairs. The contacts traced from slope raster maps generated from LiDAR showed improvement on previous work. Combined with traditional field mapping and calibration to measured sections, this technique can be a useful mapping tool for certain geologic settings.

Session No. 5

Structural Geology: Geometry and Kinematics from Mapping and Modeling
Sunday, 1 November 2015: 8:00 AM-12:00 PM

Room 336 (Baltimore Convention Center)

Geological Society of America *Abstracts with Programs.* Vol. 47, No. 7, p.34

Back to: Structural Geology: Geometry and Kinematics from Mapping and Modeling

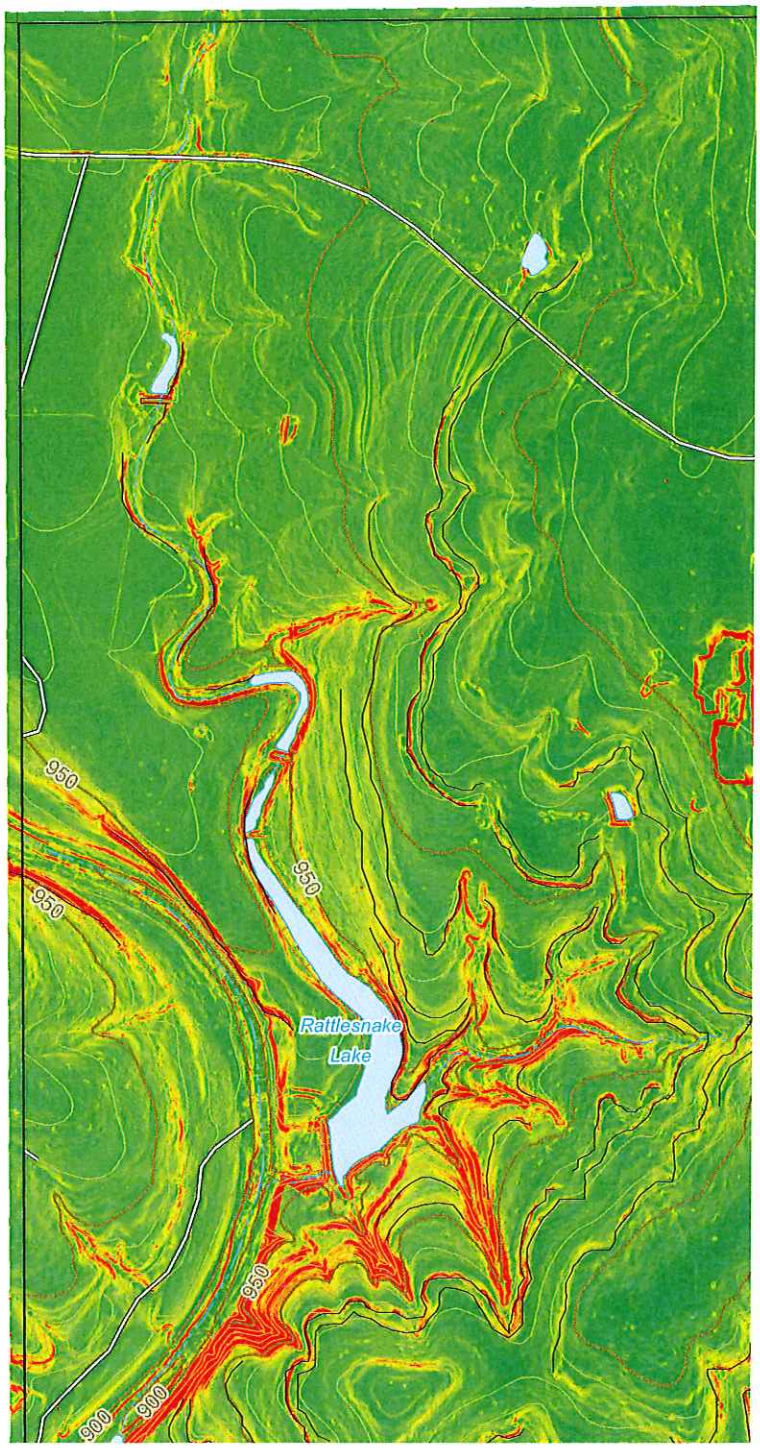
<< Previous Abstract | *Next Abstract*

Attachment B.

Marissa Mapping on LIDAR Slope Map of the Mountain City Quadrangle

98°0'0"W

0°7'30"N



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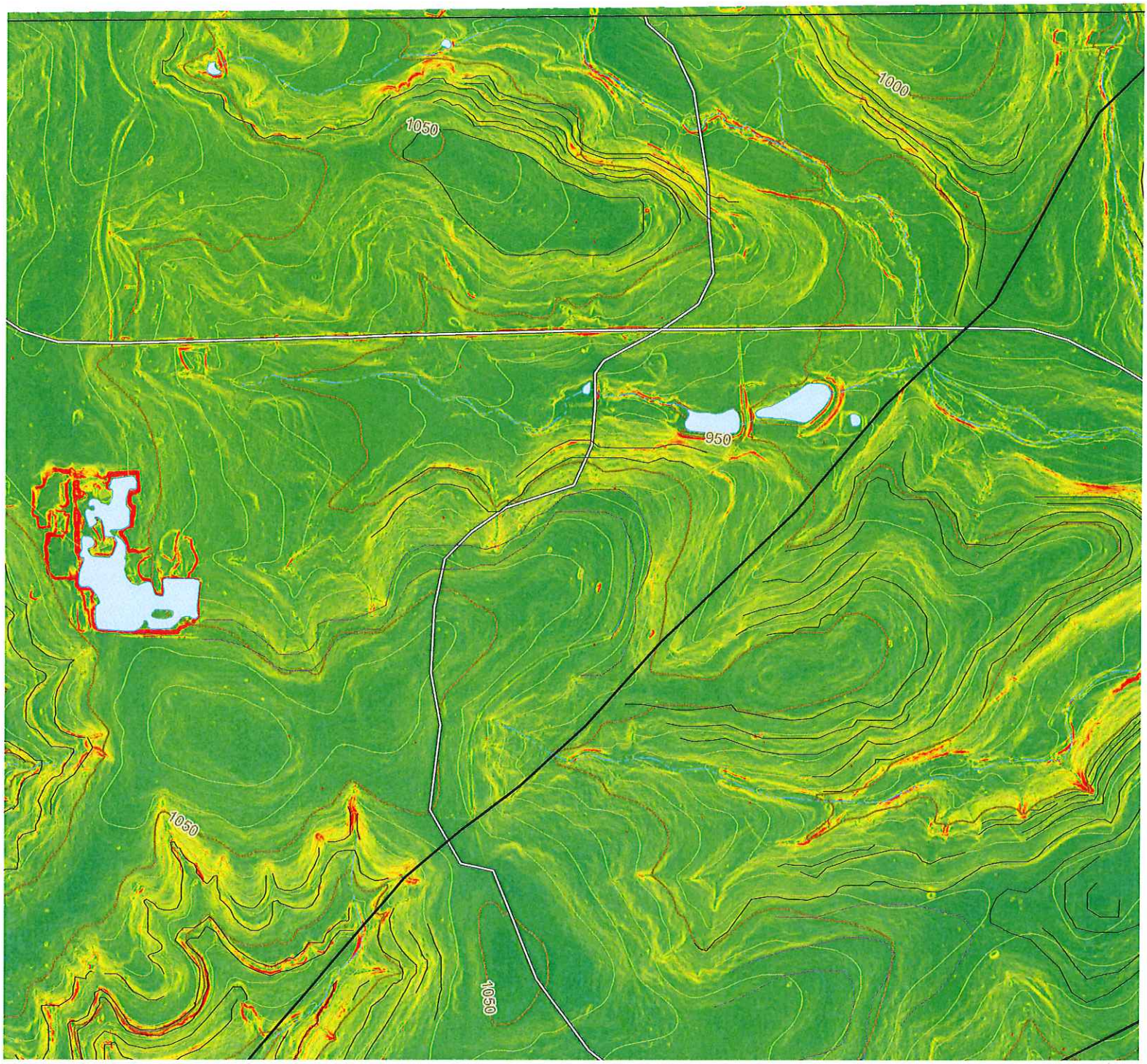

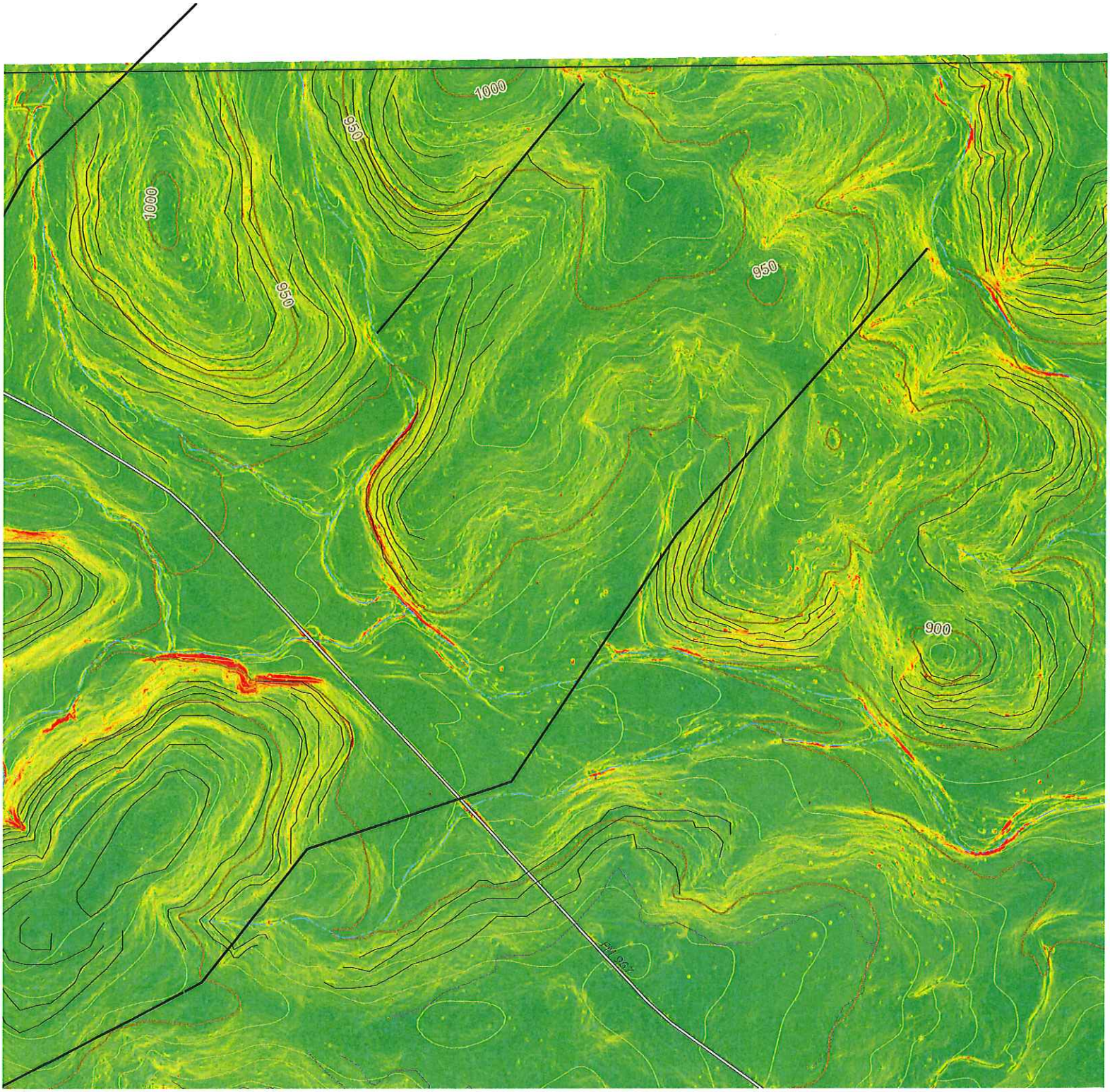
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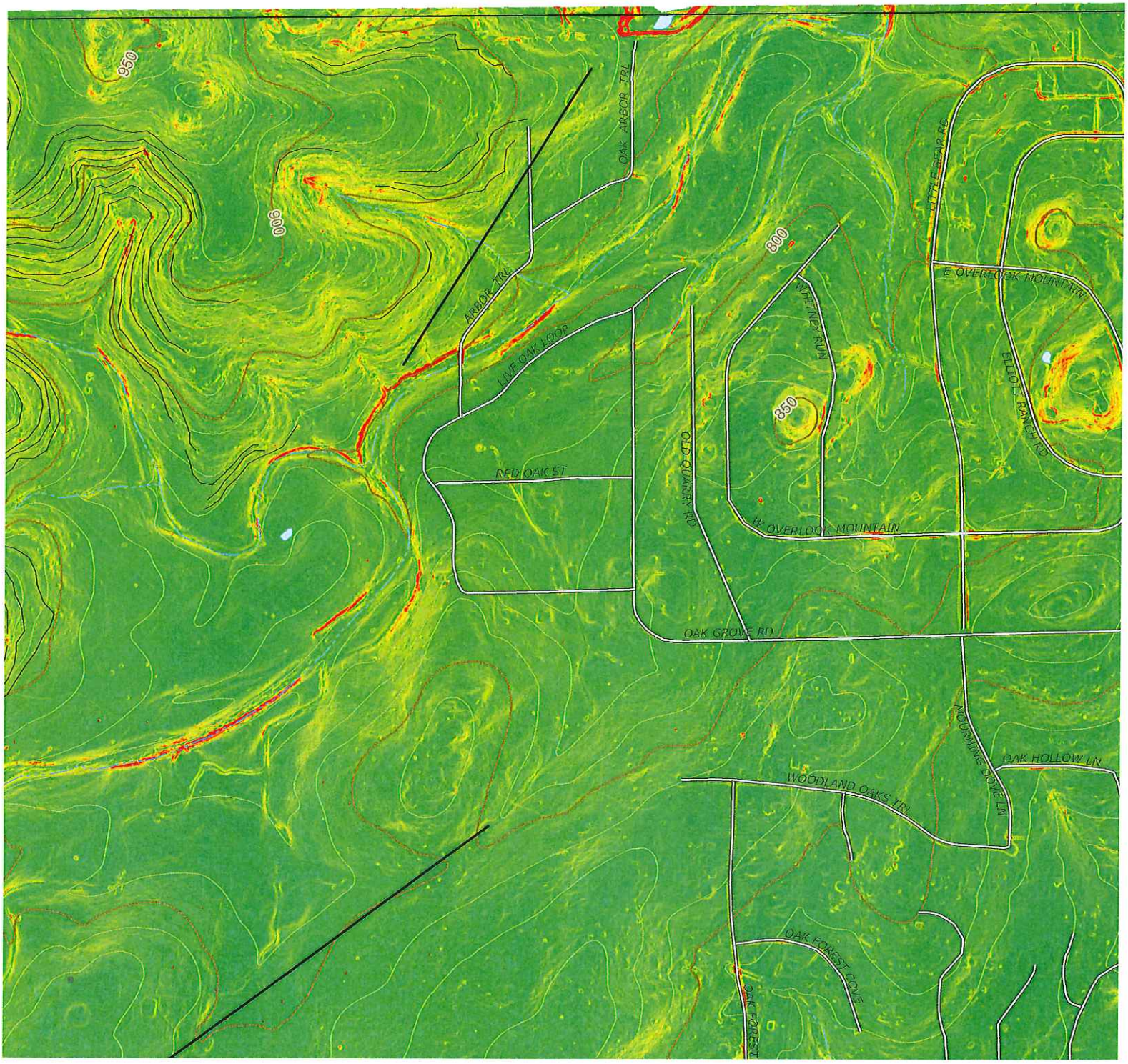
950
1000
950
950
900
FM 967

97°55'0"W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900
850
800
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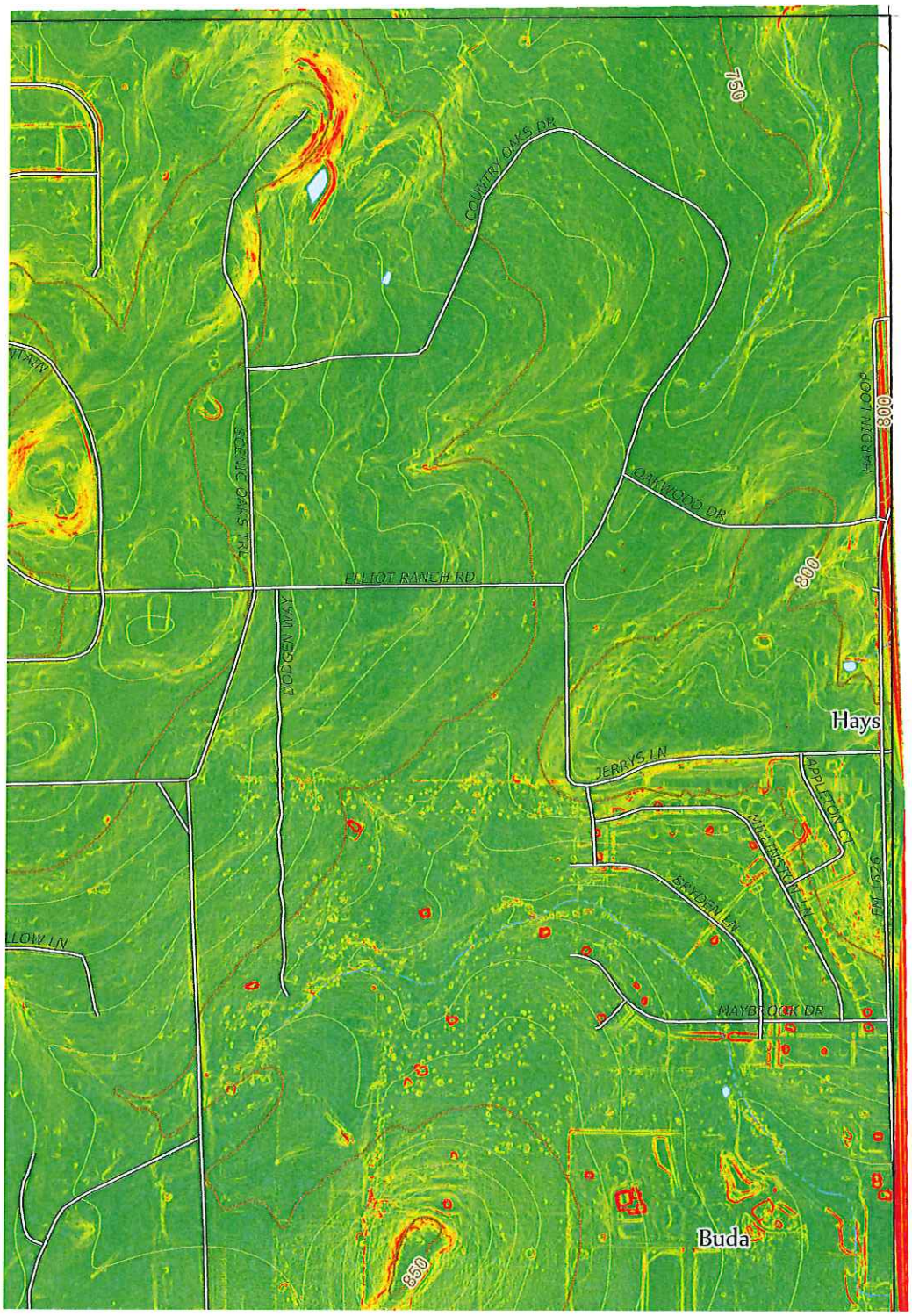
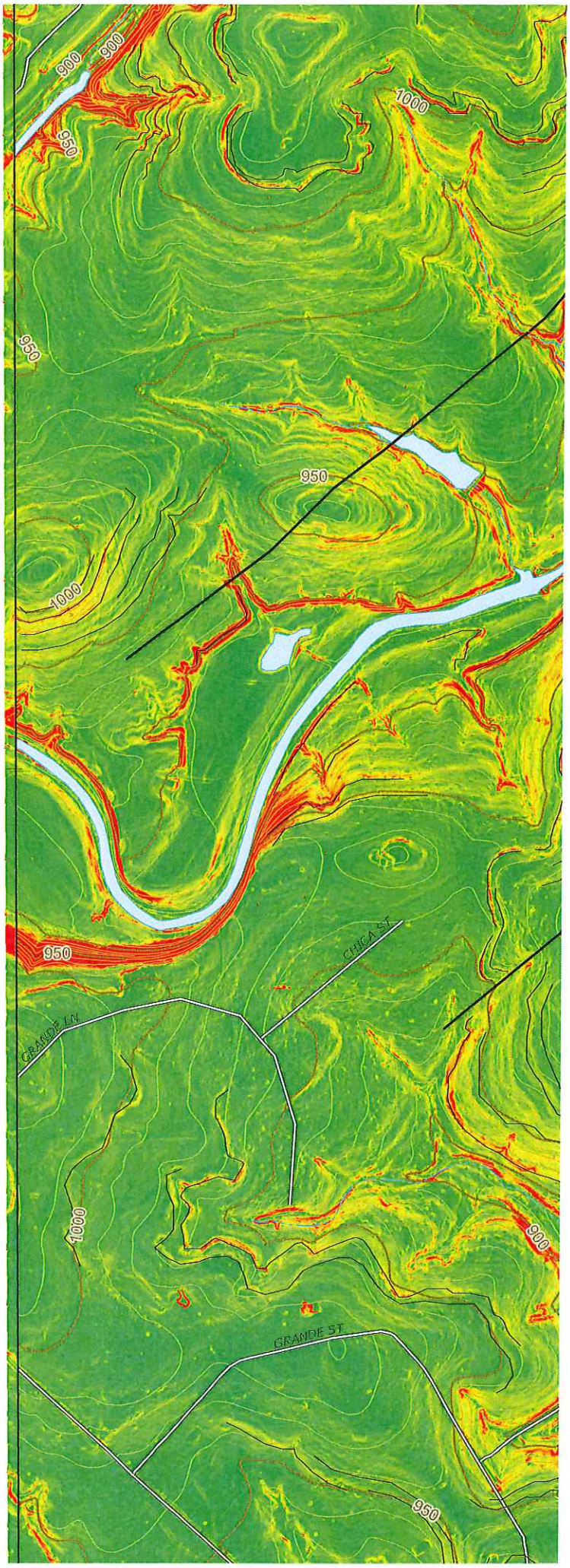
ARBOR TRL
LIVE OAK LOOP
RED OAK ST
OLD QUARRY RD
WHITNEY RUN
LITTLE BEAR RD
E OVERLOOK MOUNTAIN RUN
BUDDY RANCH RD
E OVERLOOK MOUNTAIN
OAK GROVE RD
MOURNING DOVE LN
OAK HOLLOW LN
WOODLAND OAKS TRL
OAK FOREST COVE
OAK FOREST


97°52'30"W
30°7'30"N
750
800
850
COUNTRY OAKS DR
SCENIC OAKS TRL
ELLIOT RANCH RD
DODGEN MAY
OAKWOOD DR
FOOT MCGRAW
Hays
JERRYS LN
APPLETON CT
BRIDGEN LN
MAYBROOK DR
Buda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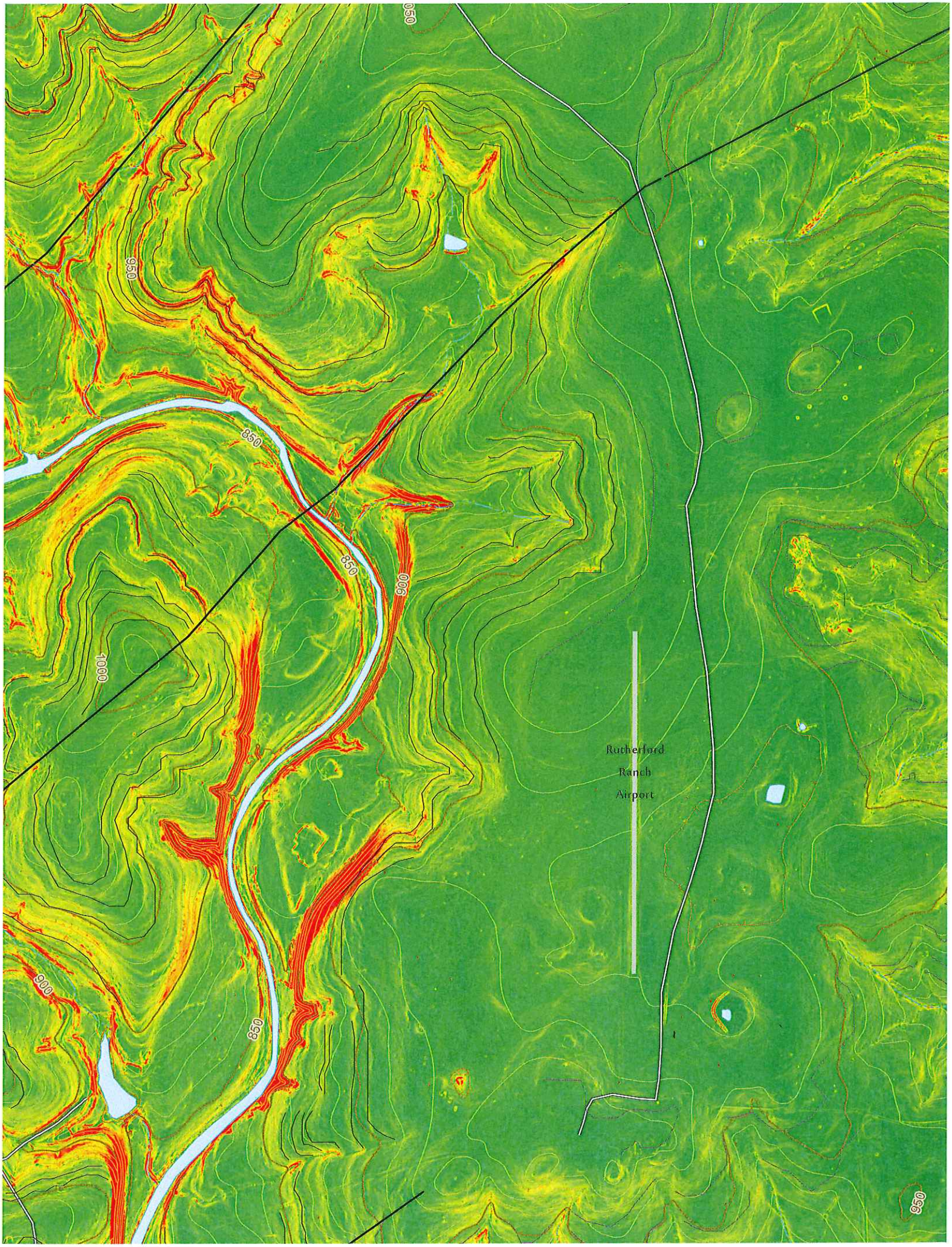
950
CHICA ST
GRANDE LN
1000
900
GRANDE ST
950

30°5'0"N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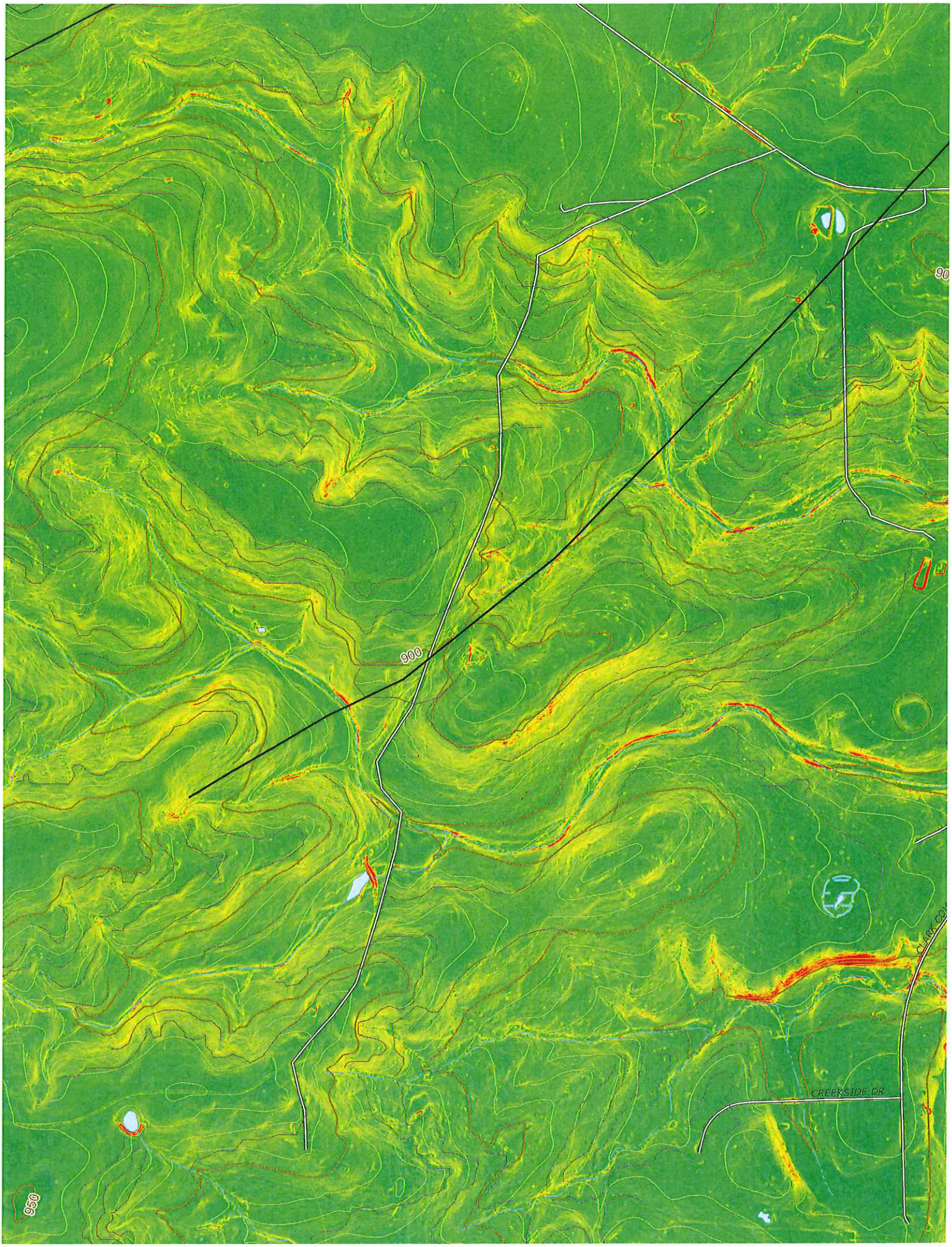
Rutherford
Ranch
Airport
950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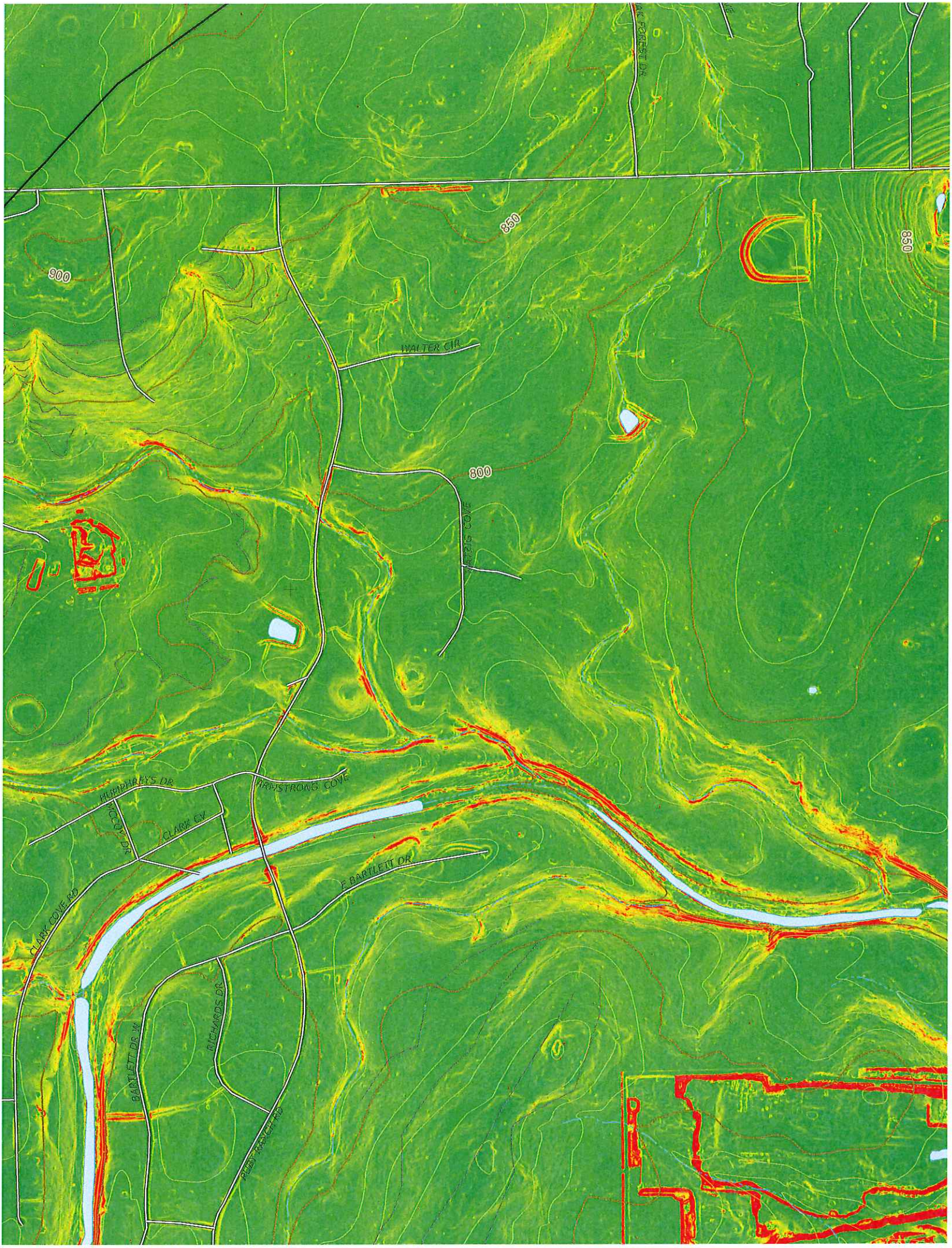
950
CREEKSIDE DR


OAK FOREST DR
850
900
850
WALTER CIR
800
ARMSTRONG COVE
HUMPHREYS DR
ARMSTRONG COVE
CLARK CV
CLARK COVE RD
E BARTLETT DR
BARTLETT DR W
RICHARDS DR
REDSTONE CREEK RD


Buda
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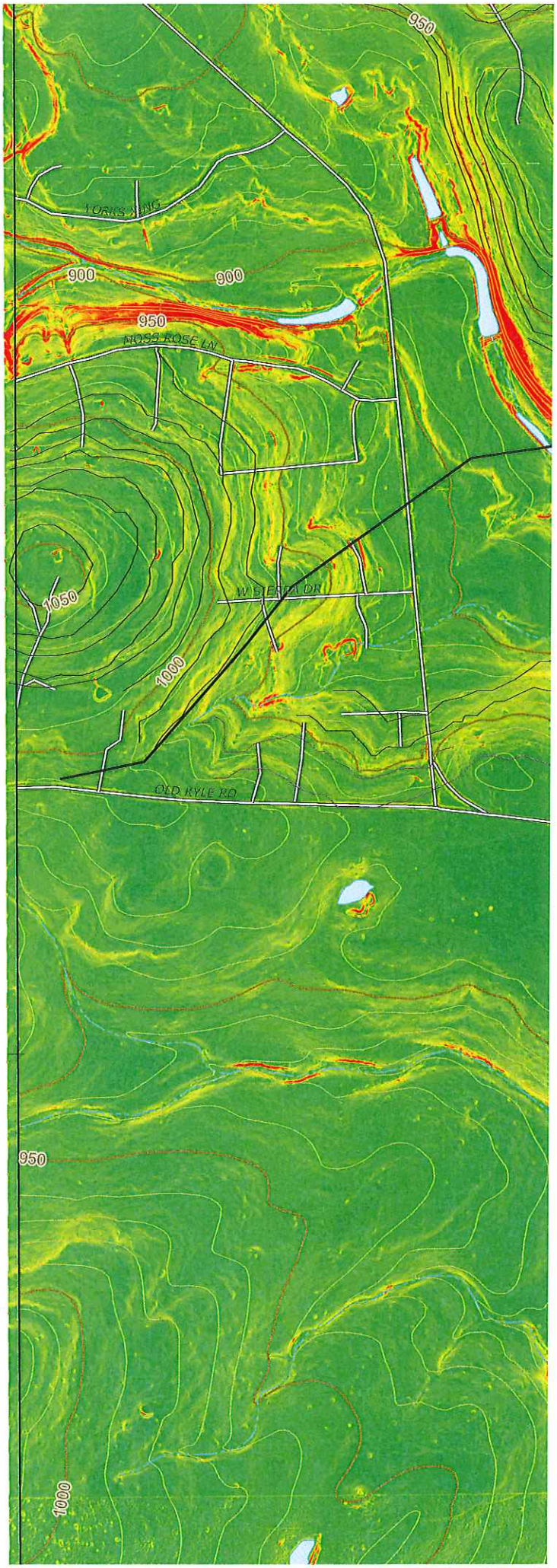
BEACON HILL RD
850
CO RD 147
750
750
700
700
30°5'0"N



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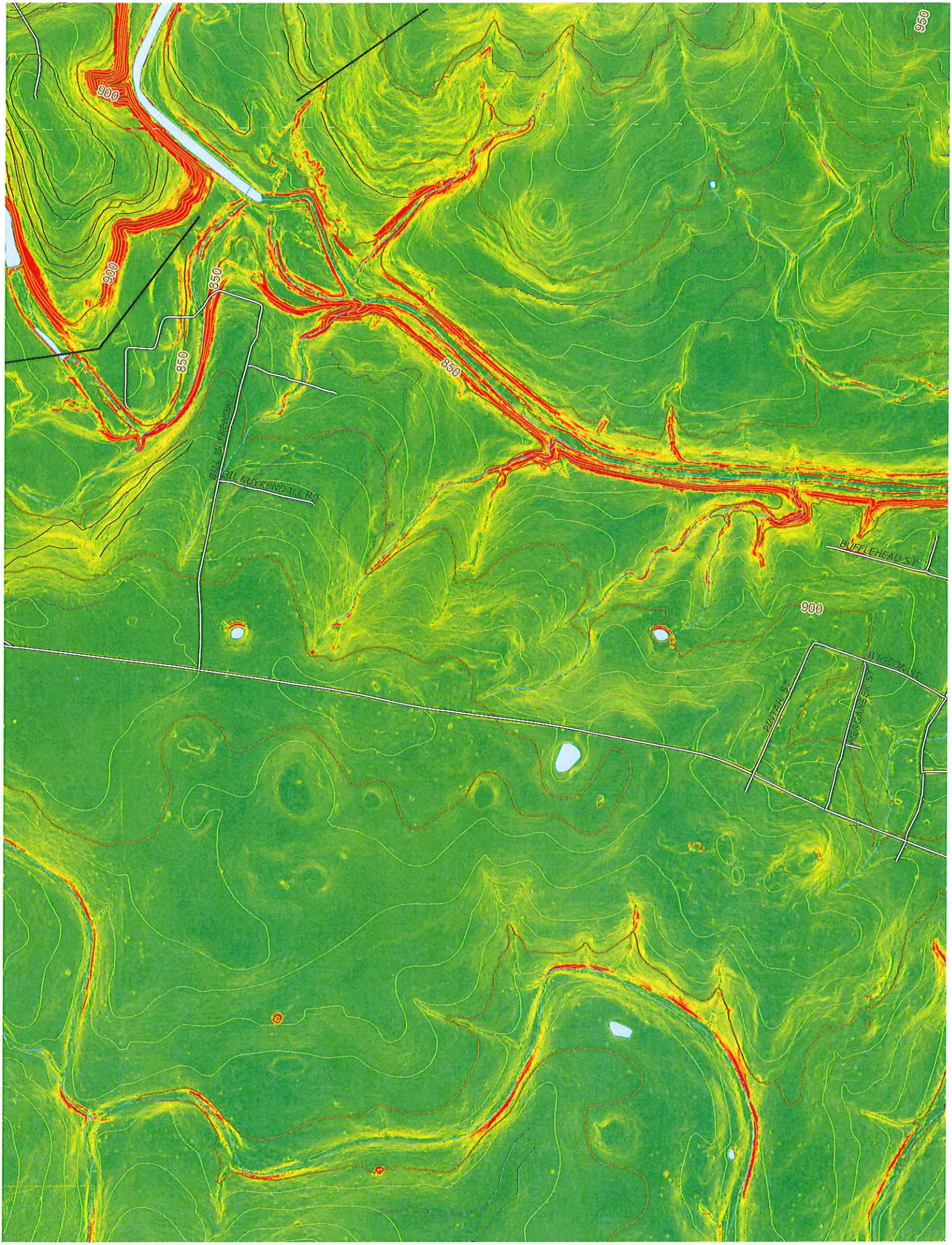
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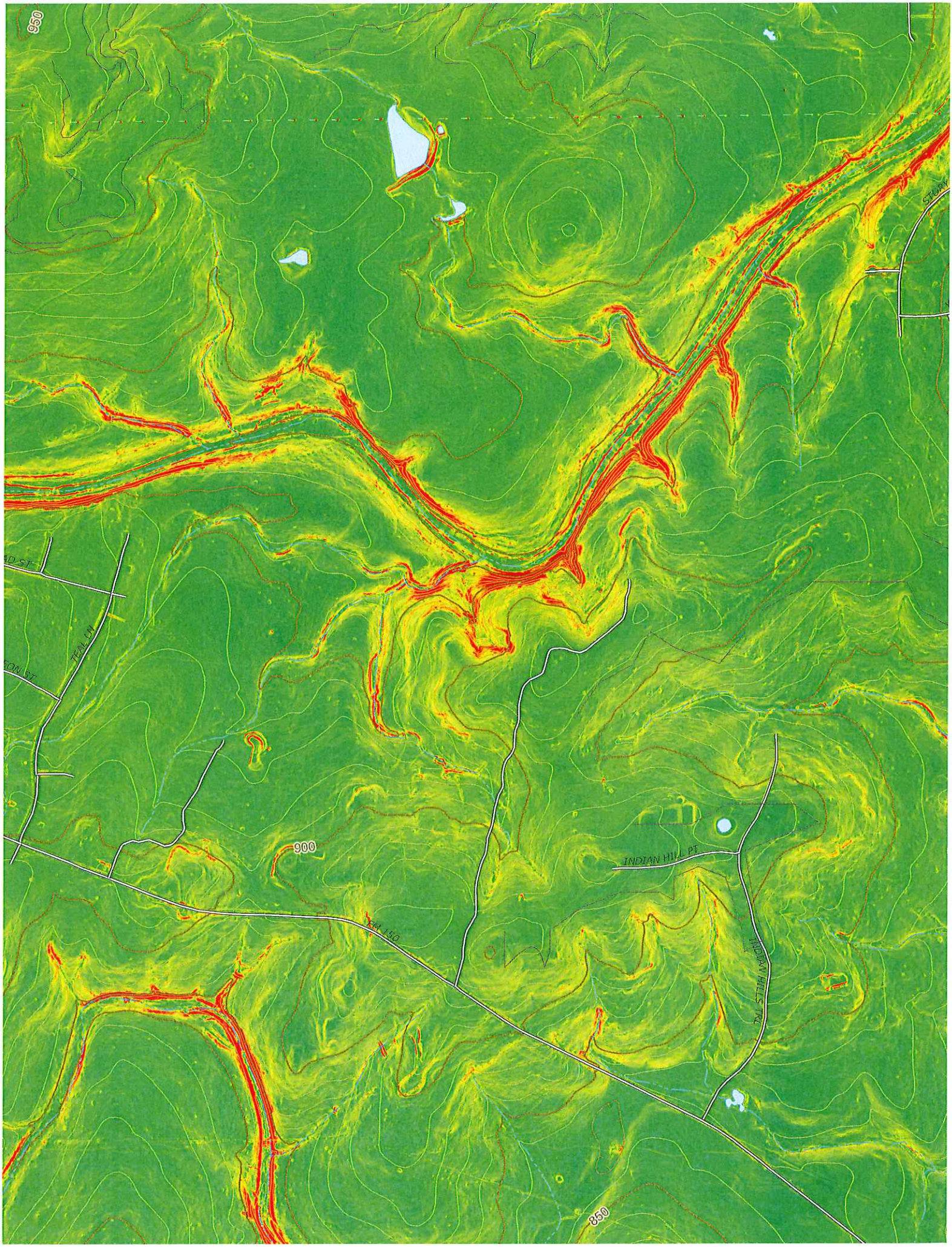
BILL KUYKENDALL RD
BUFFLEHEAD ST
900
PINTAIL ST
MERGANSER ST
WIGEON ST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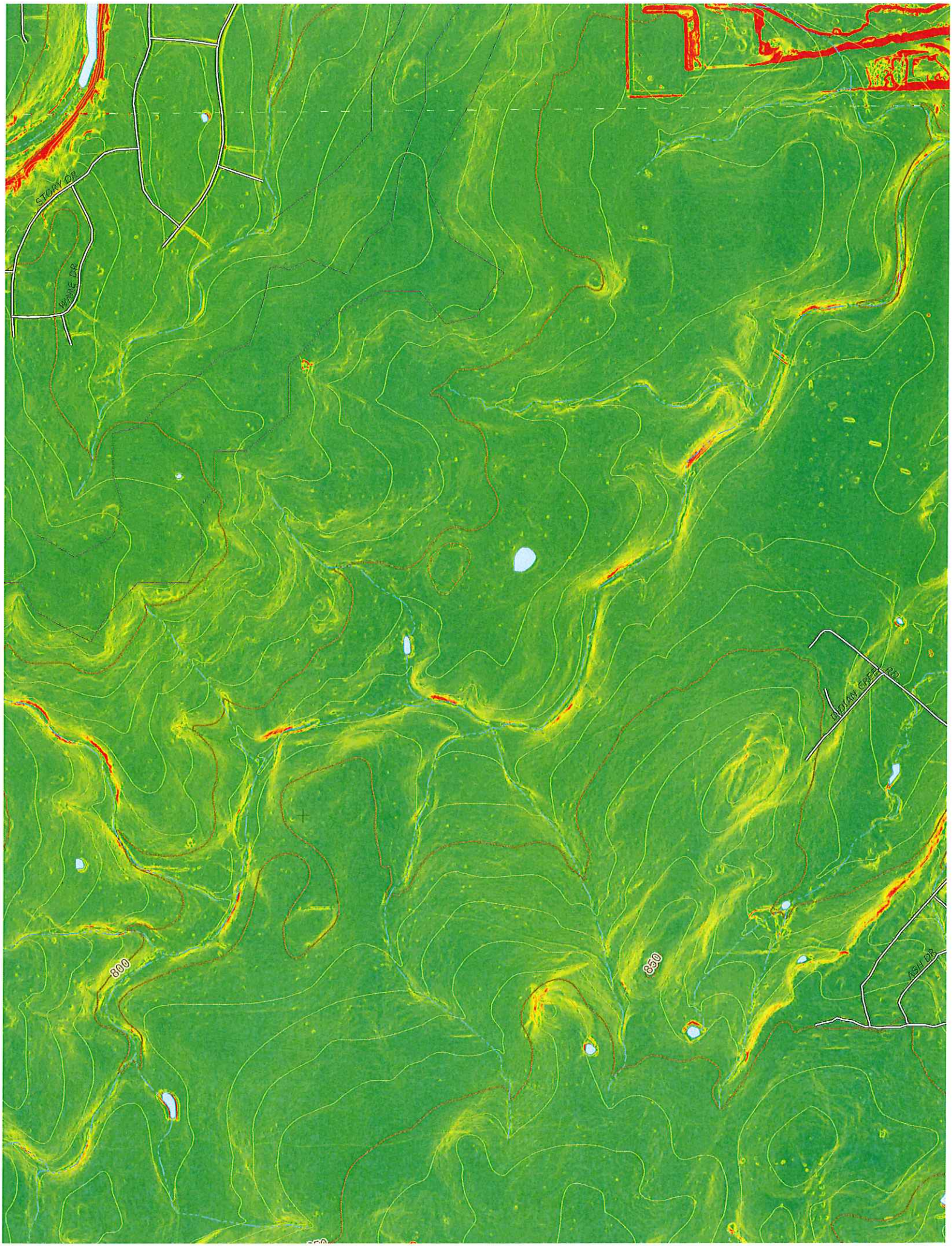
900
850
TEAL LN
INDIAN HILLS TRL
INDIAN HILL PT
FM 150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WADE DR
INDIAN CREEK RD
ASH DR
800
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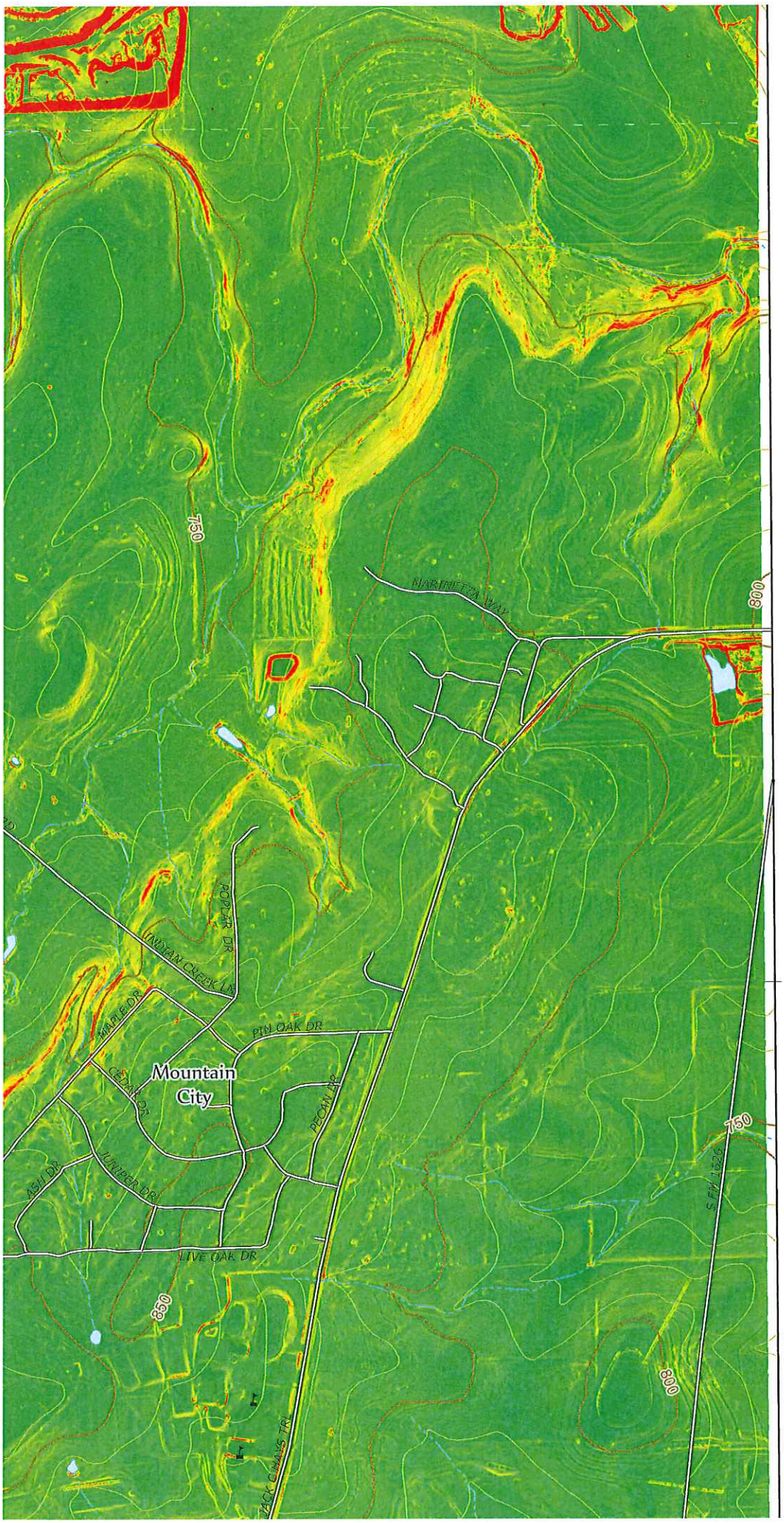
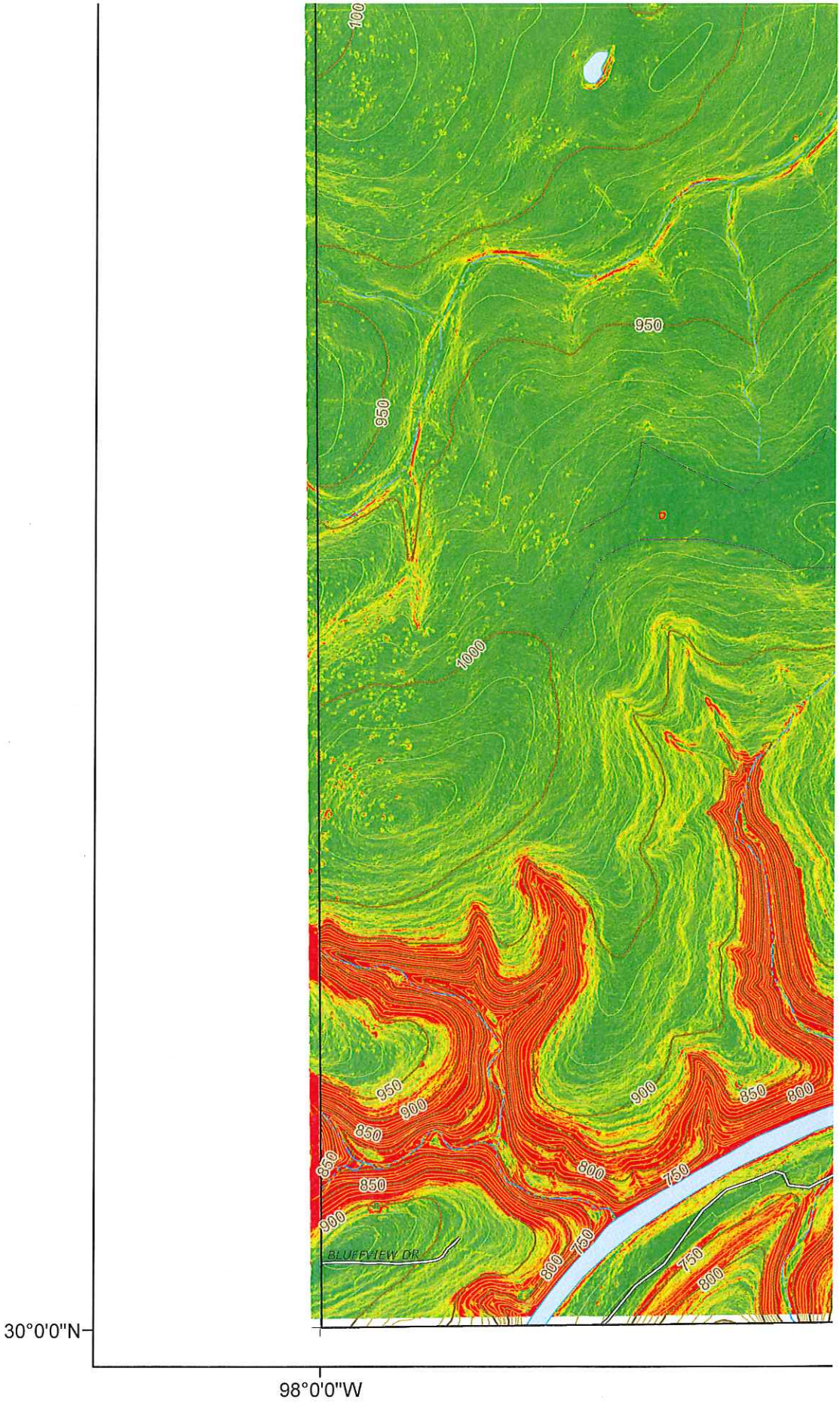

750
800
MARTINGTON WAY
POPLAR DR
INDIAN CREEK LN
MAPLE DR
PIN OAK DR
CEDAR DR
PECAN DR
Mountain City
ASH DR
JUNIPER DR
LIVE OAK DR
650
ZACK CHAVIS TRL
S FM 1329
750
800

30°2'30"N


100
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750
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800
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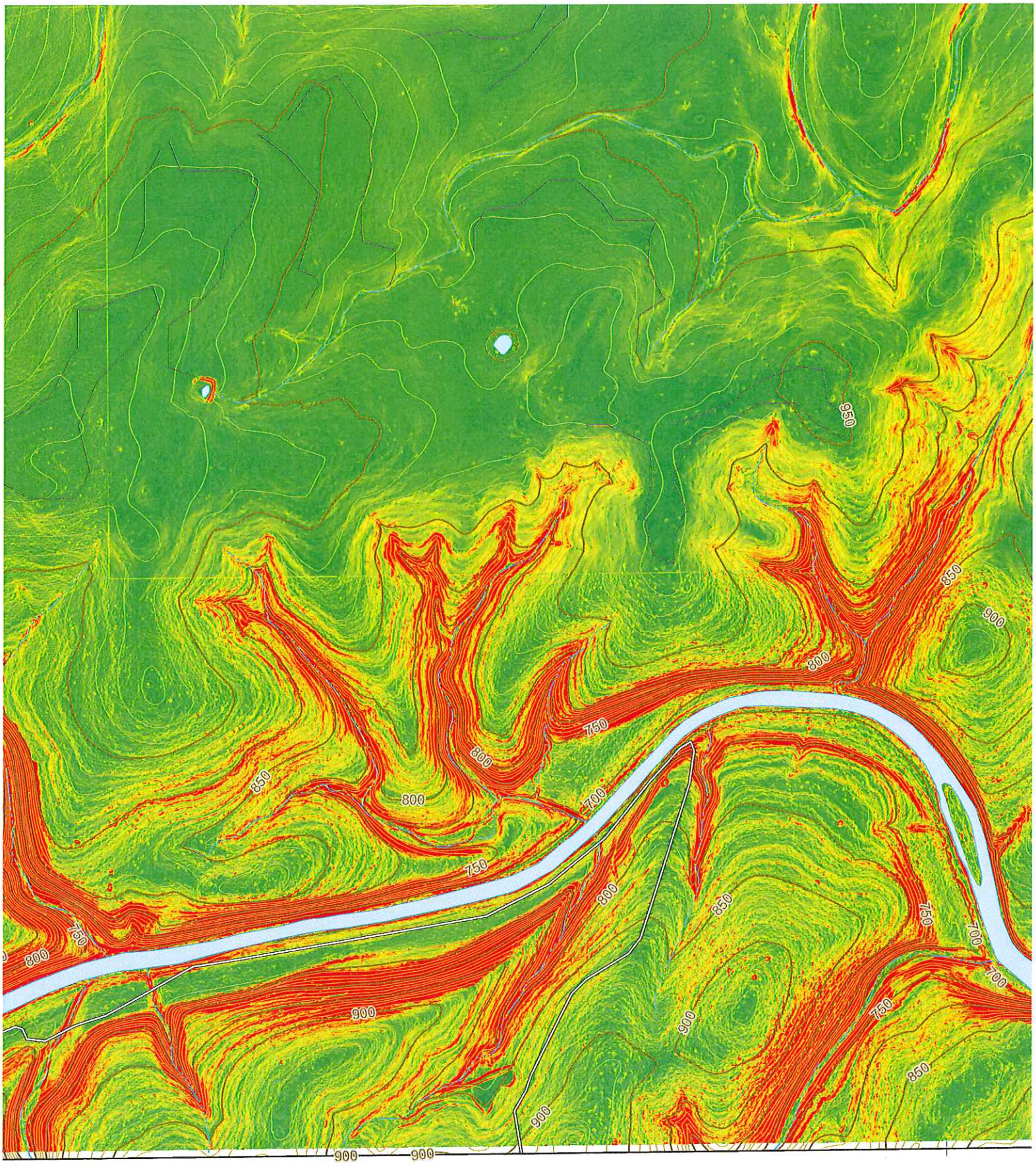
BLUFFVIEW DR
30°0'0"N
98°0'0"W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0.5
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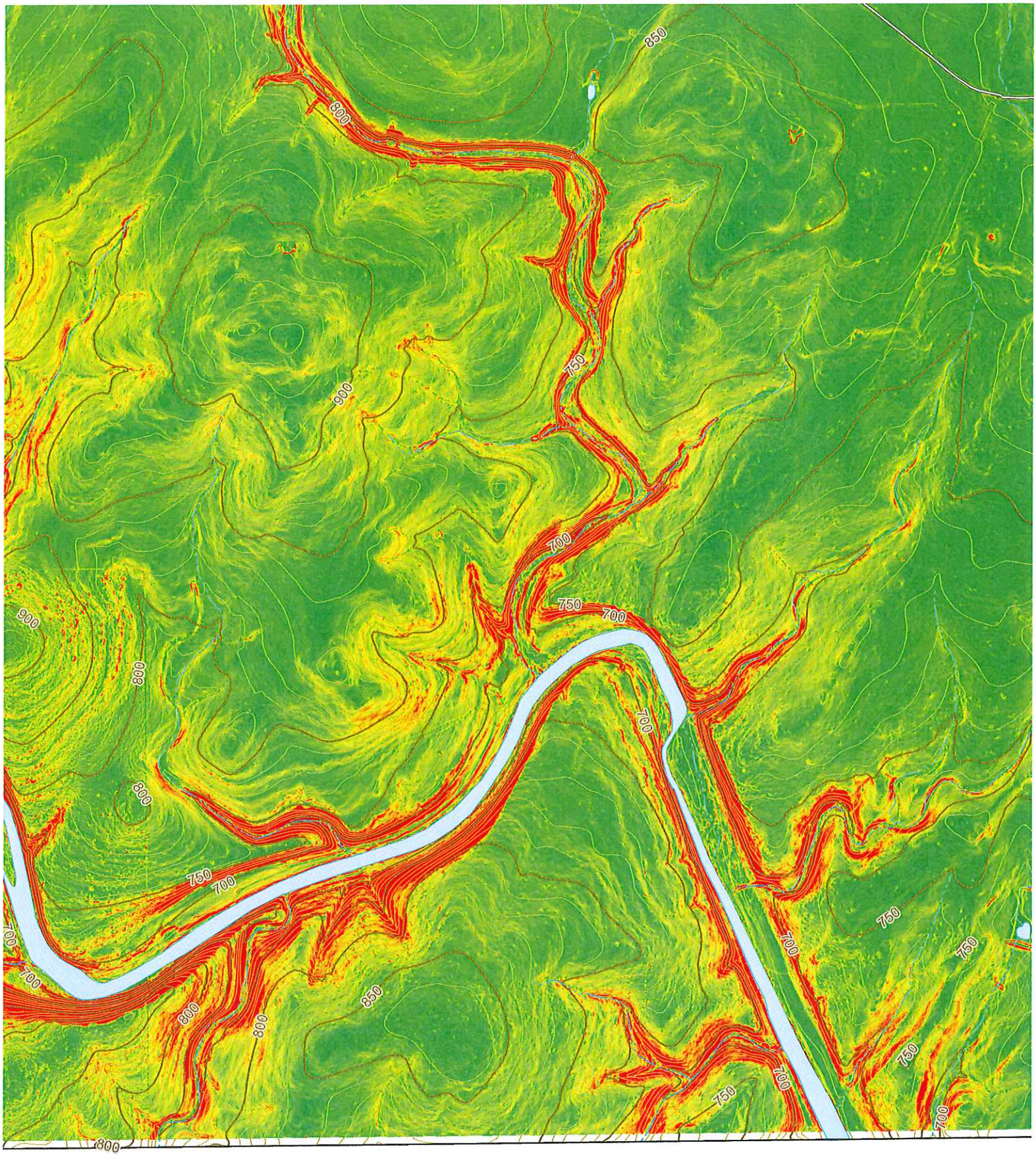

I"W

2 Miles

1:15,000

Spatial Reference is UTM Zone 14 NAD83

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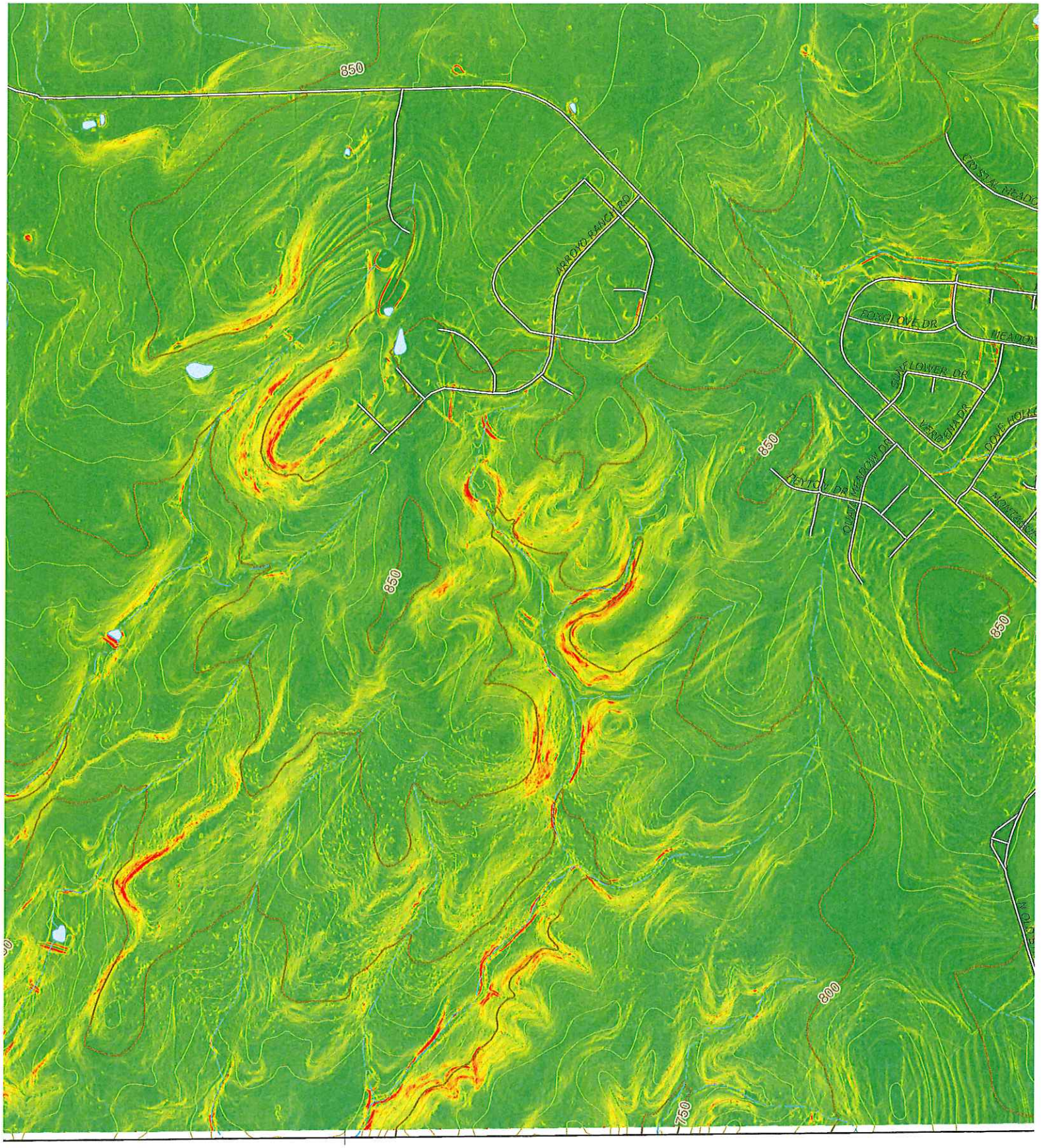
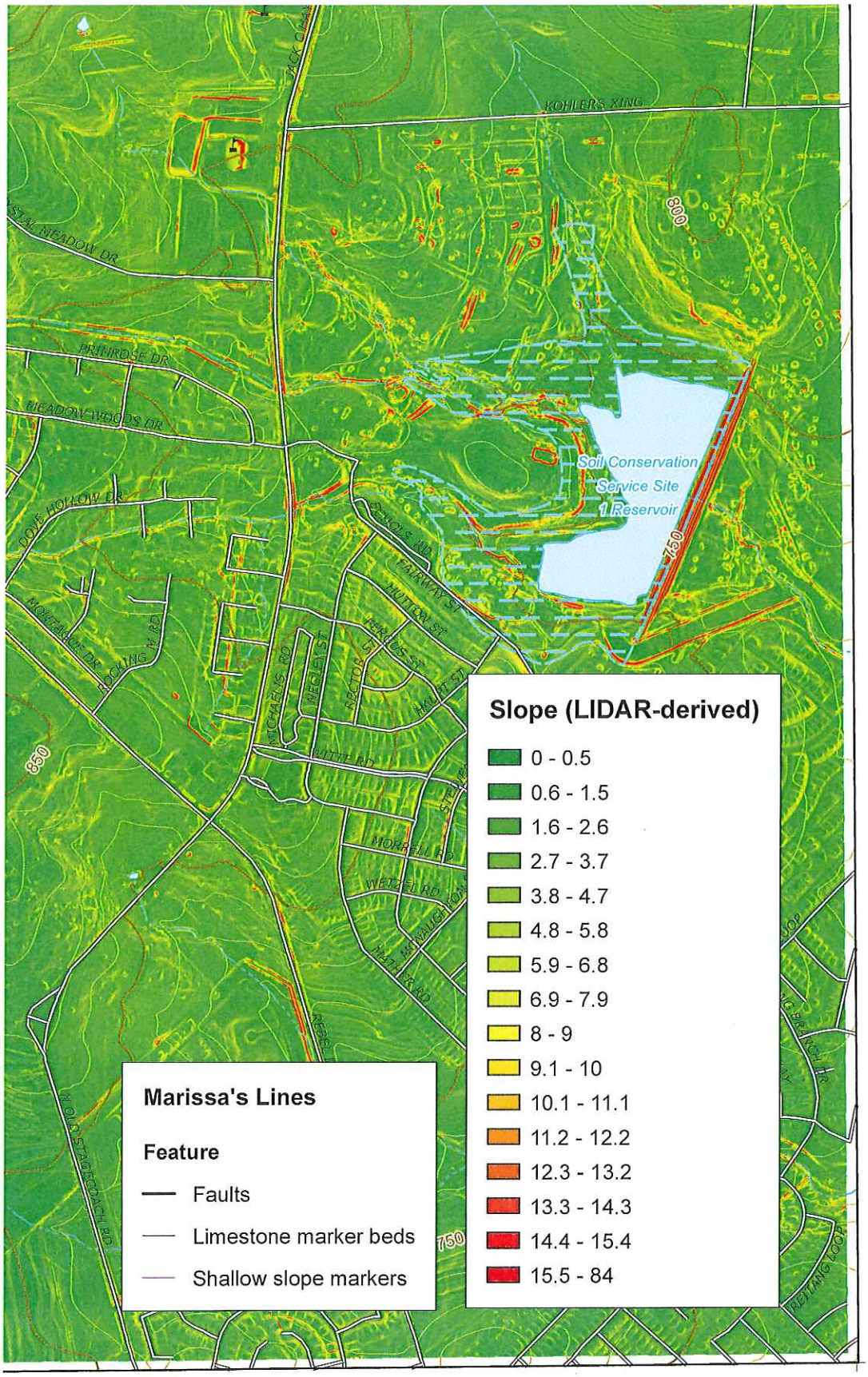


97°55'0"W

0.5 1 2 Kilometers



30°0'0"N

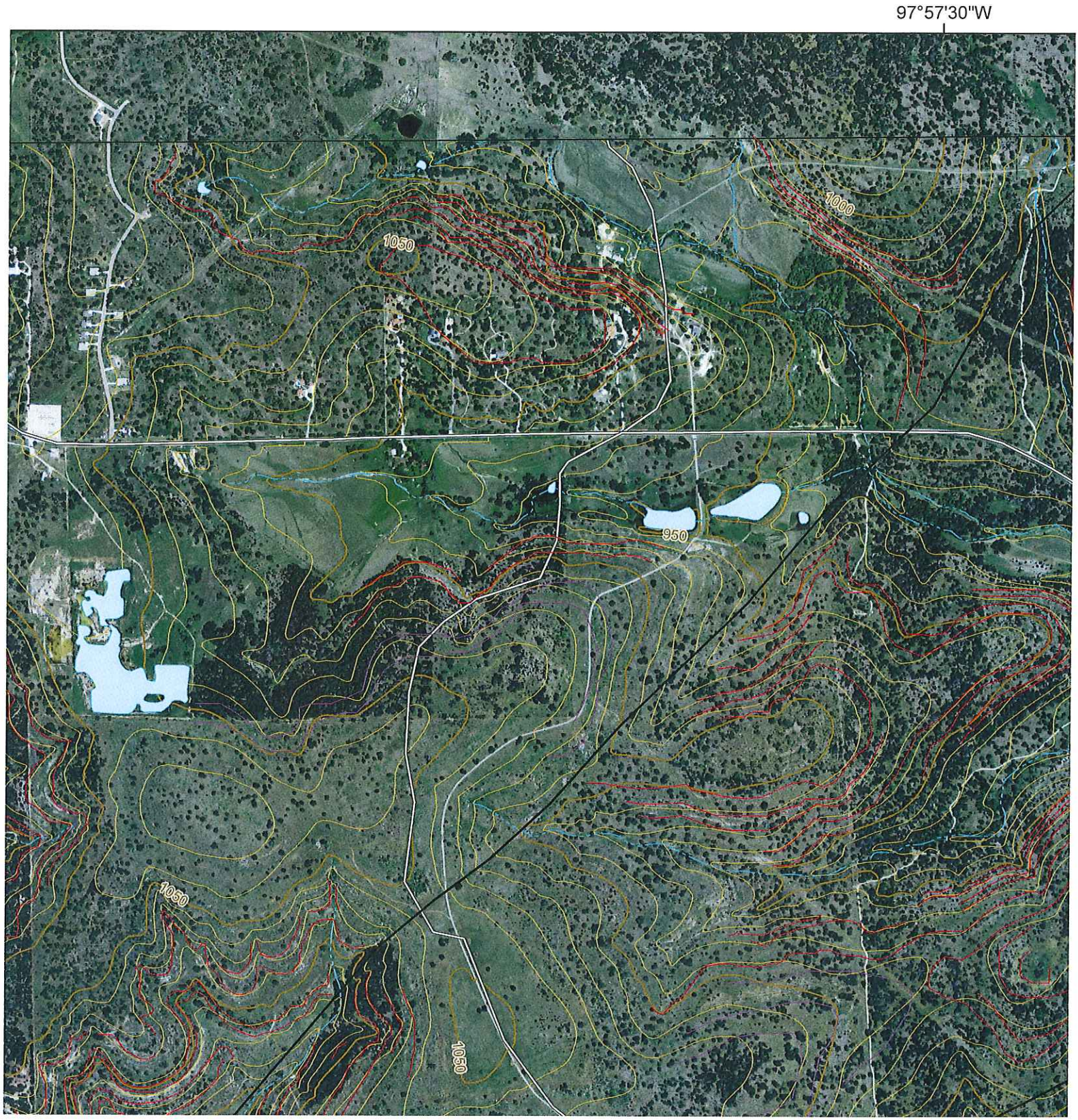
97°52'30"W

Mountain City Quadrangle, Hays Co., TX
Lines recorded by Marissa Fitchera, Fall 2013,
based on LIDAR slope map
printed 2/17/2014; M. Helper

Attachment C.

Marissa Mapping on LIDAR Digital Orthophoto of the Mountain City Quadrangle


98°0'0"W
0°7'30"N
950
950
950
900
900
Rattlesnake
Lake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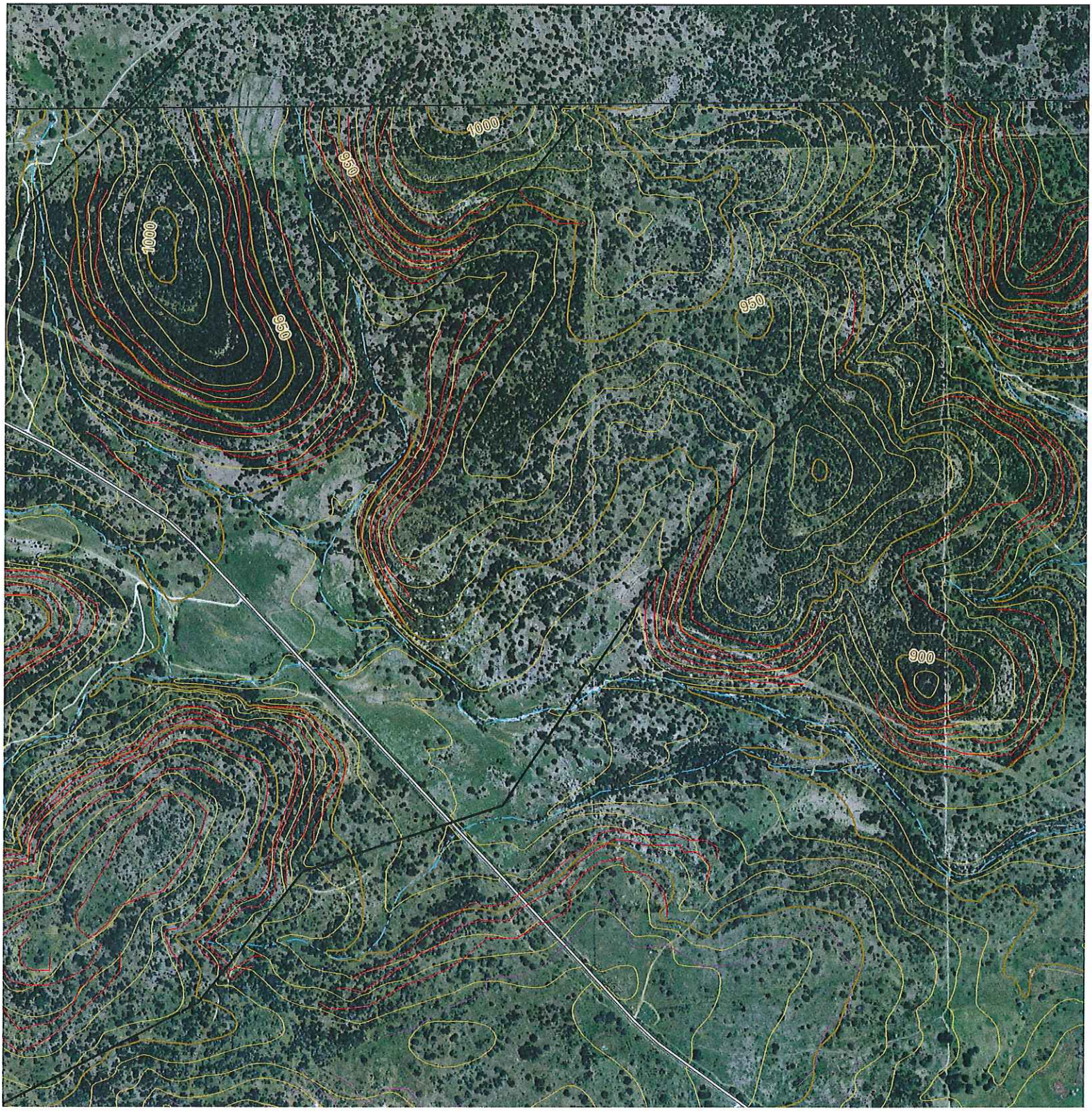
1000
1050
950
1050
1050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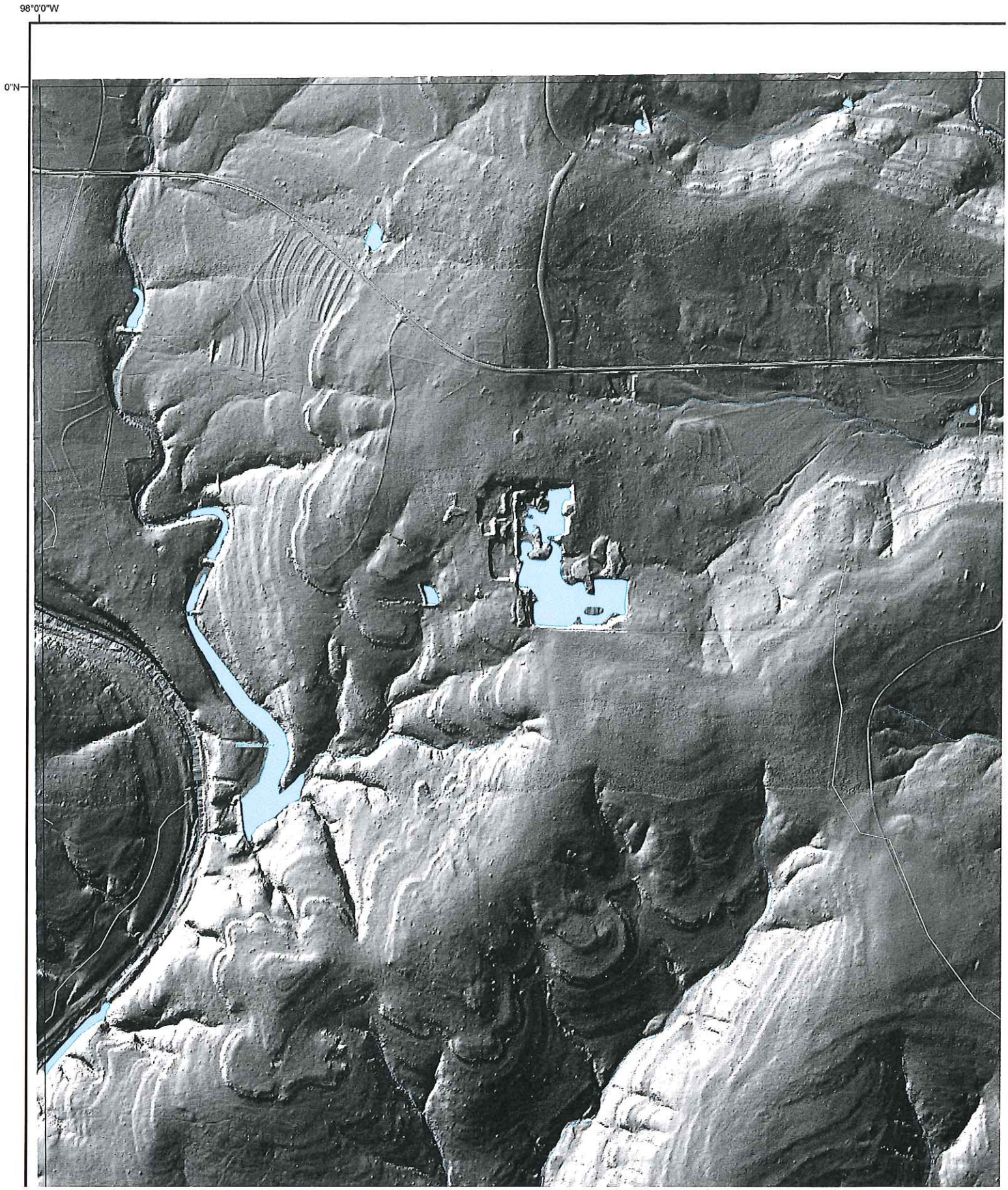
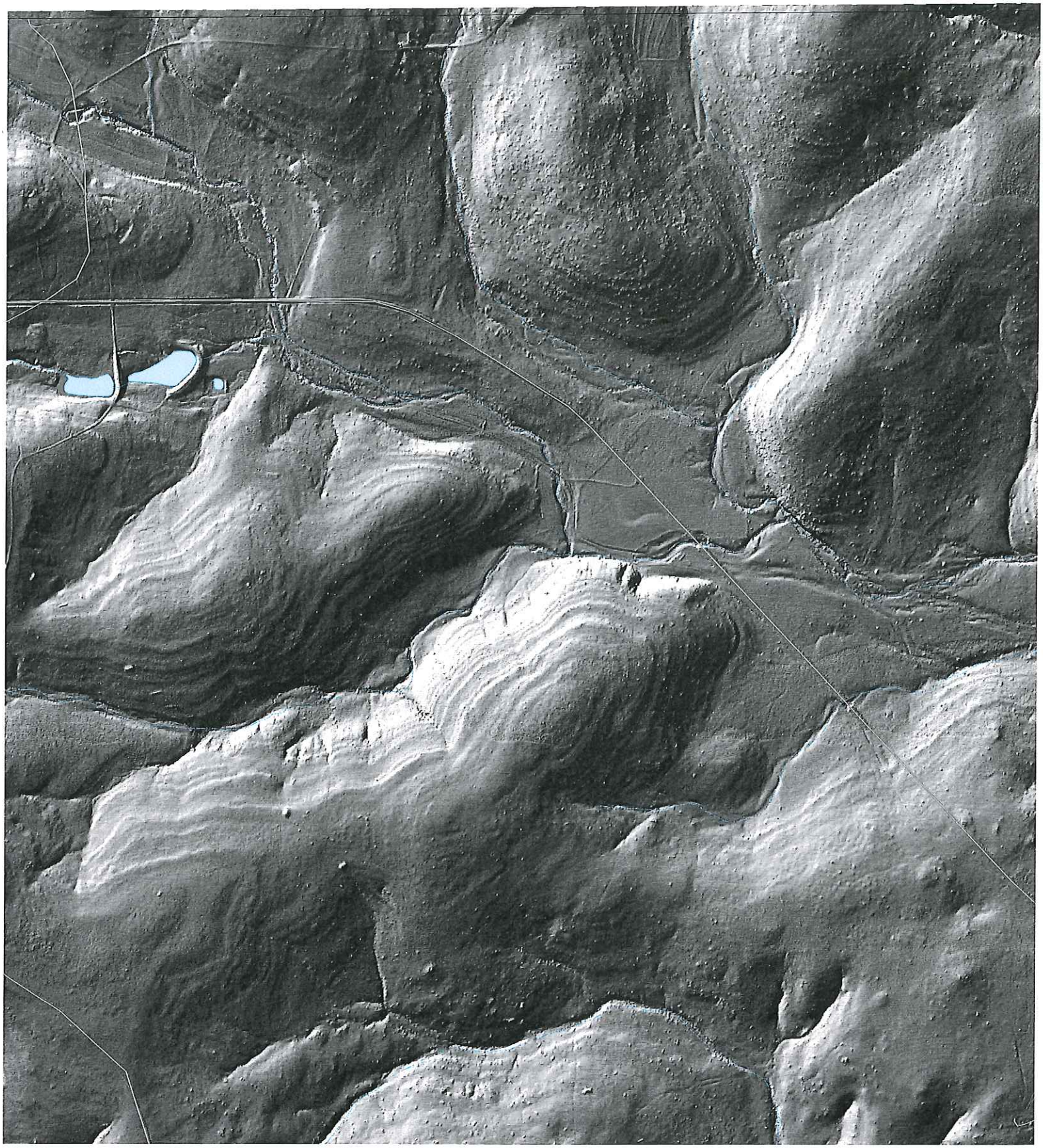
950
1000
950
950
900

Attachment D.

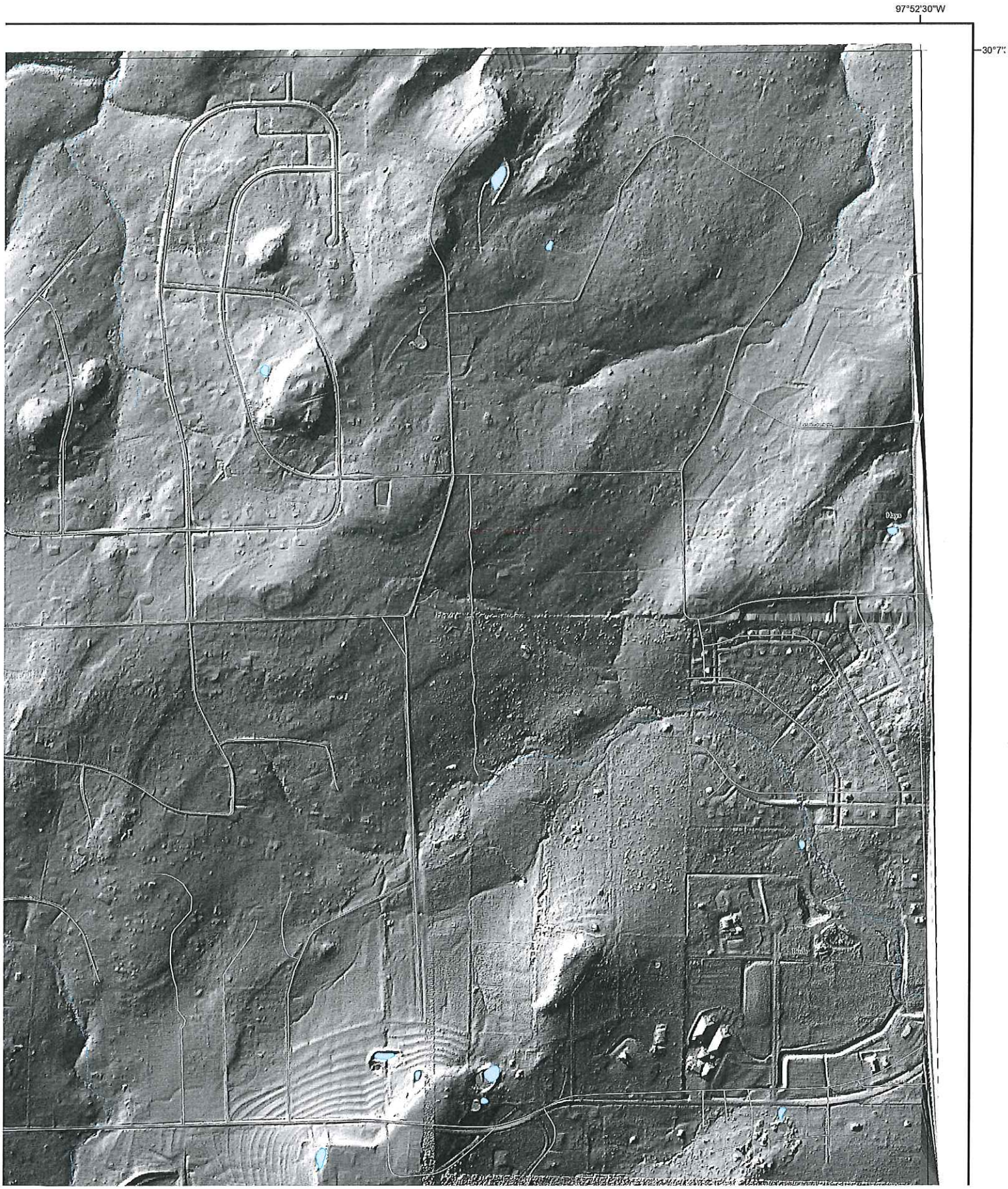
LIDAR Shade Map

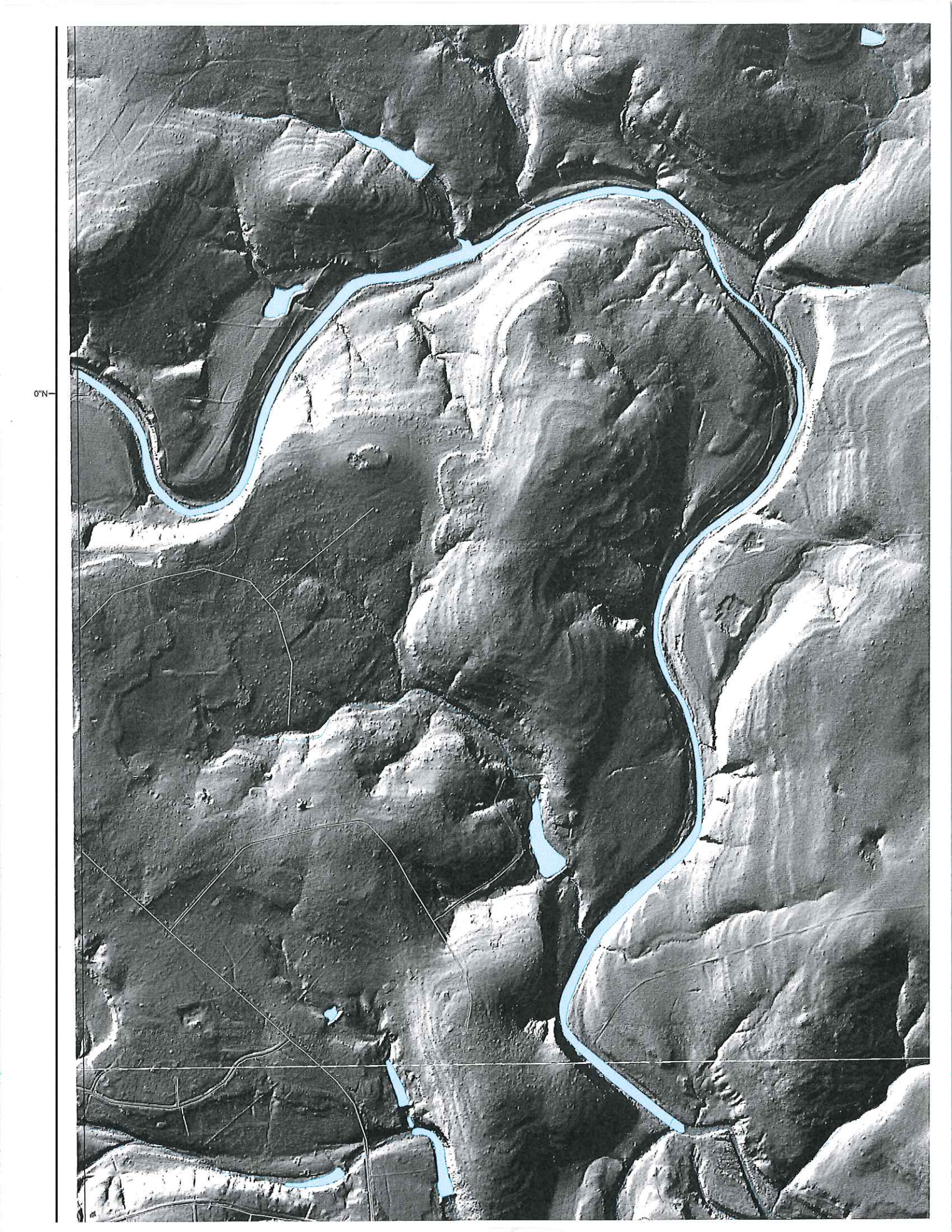

98°0'0"W
0"N

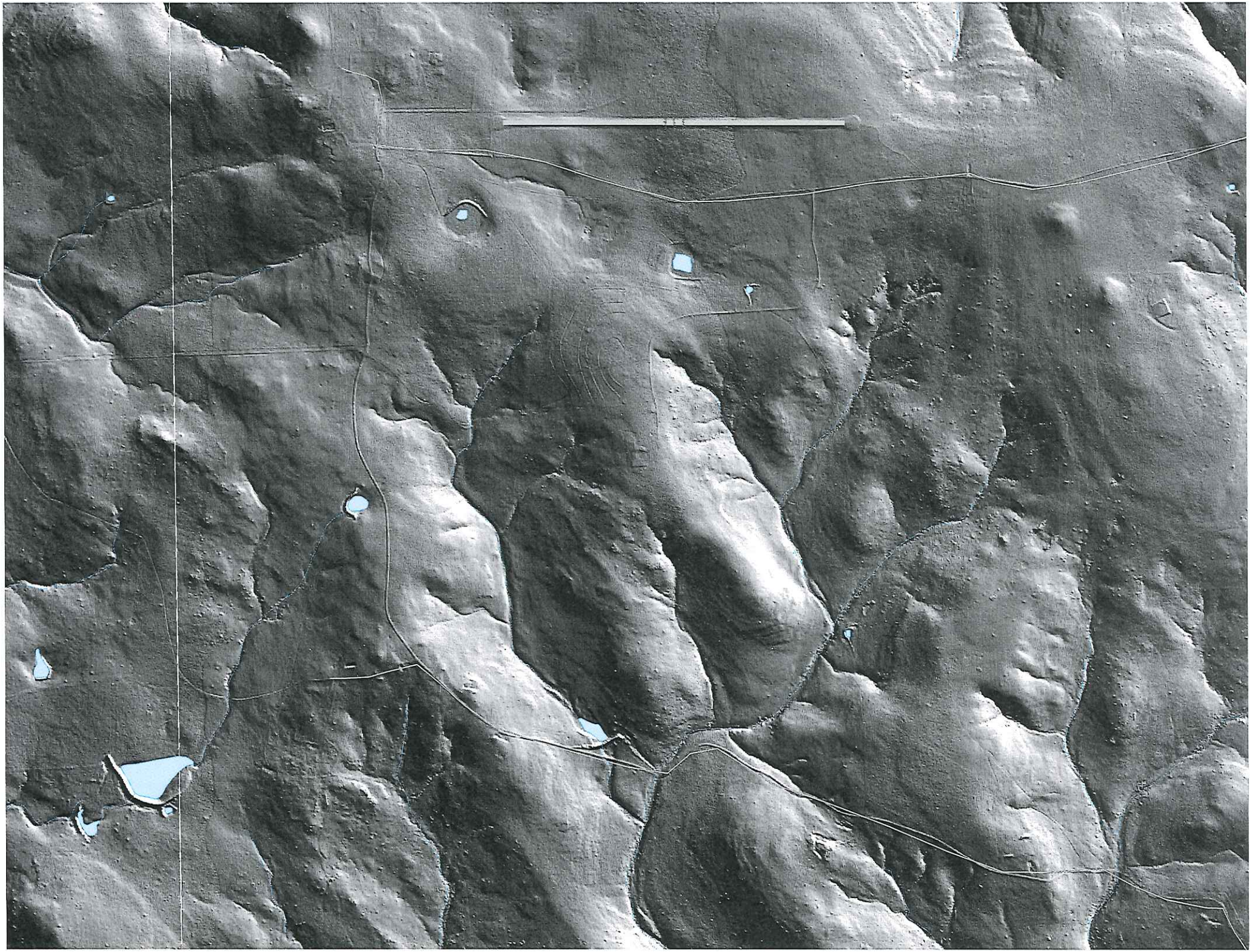
97°57'30"W

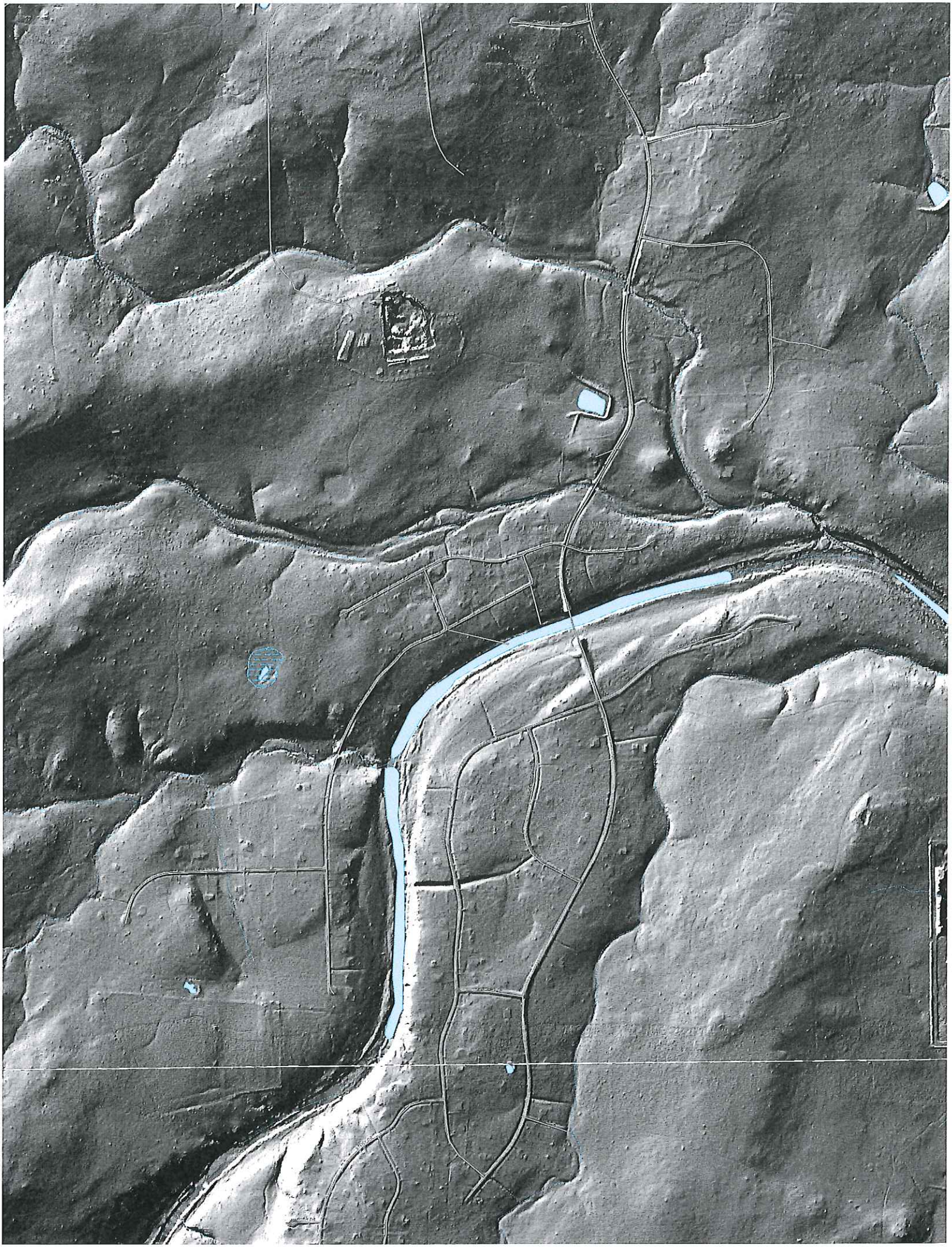


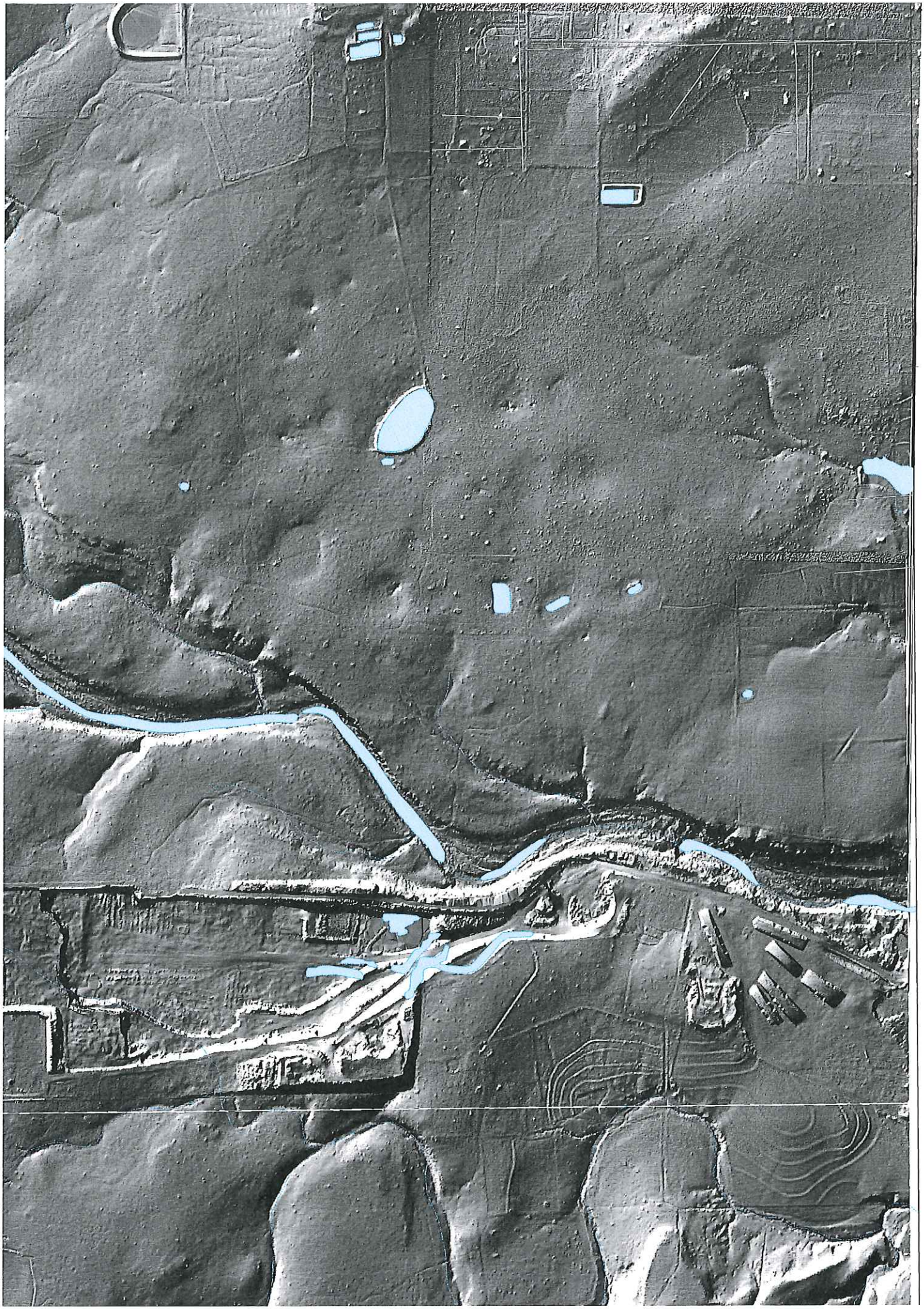

97°55'0"W


97°52'30"W
30°7'


0°N



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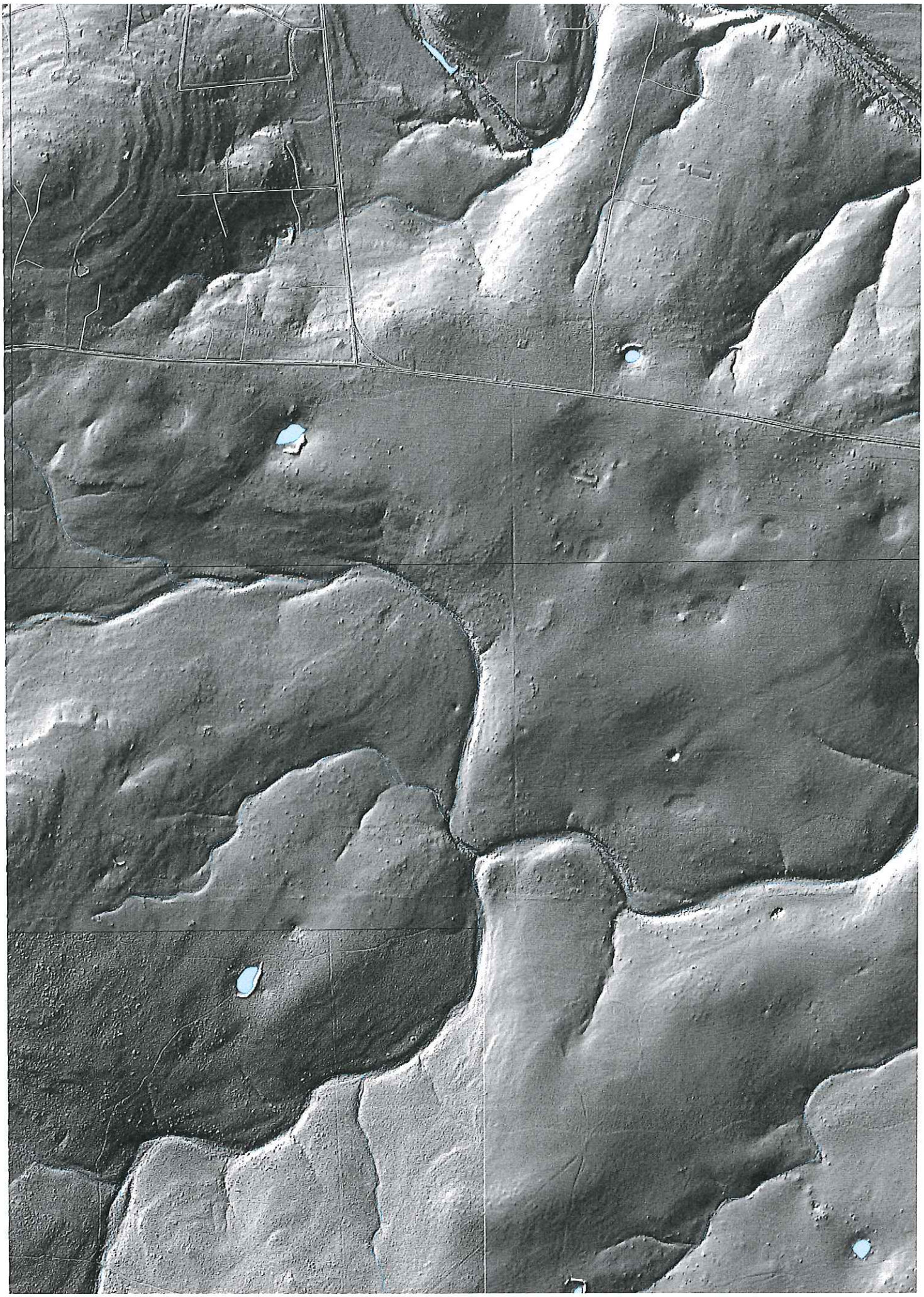
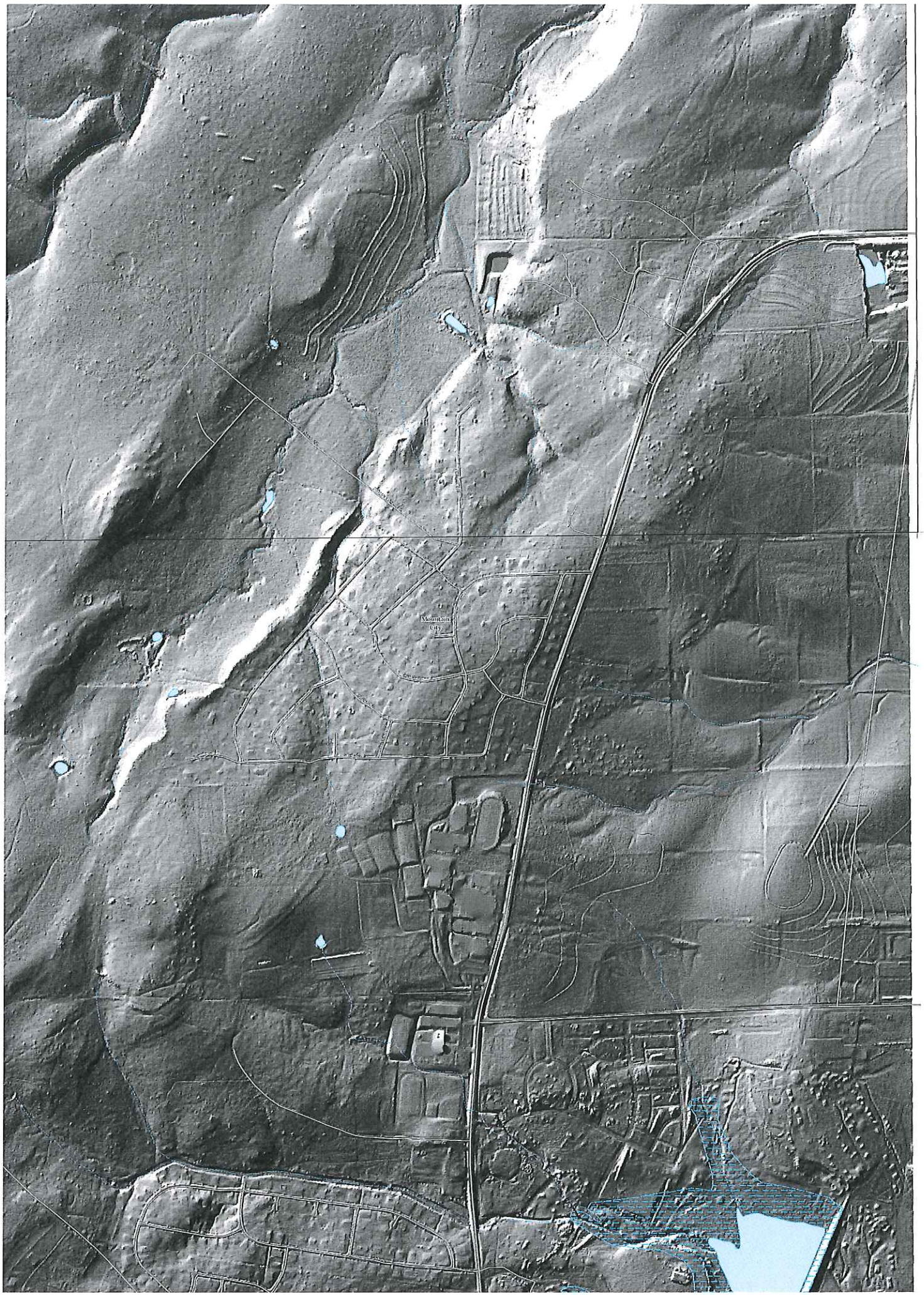
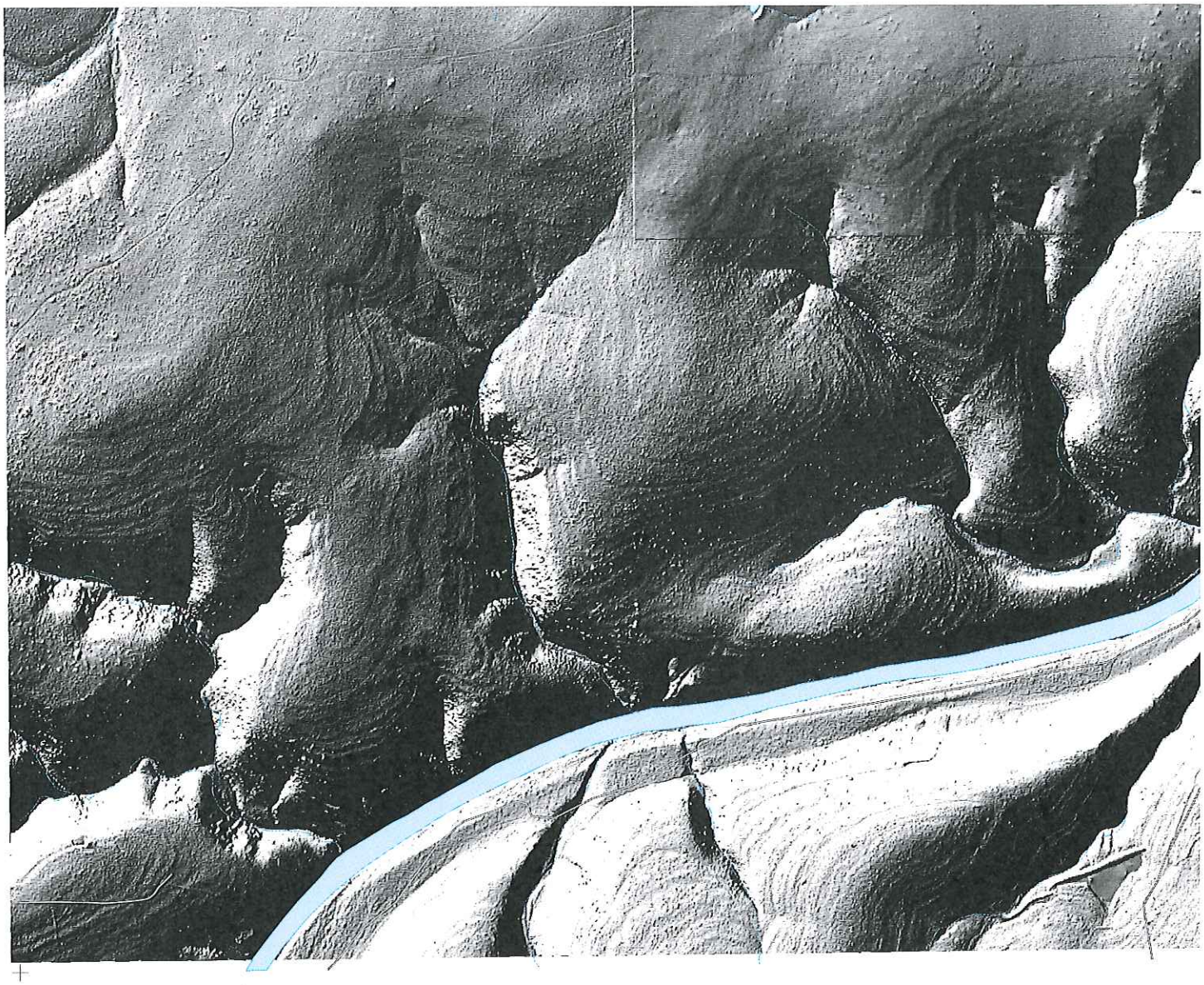

0°N


Mountain
City
30°2'



0°N

98°0'0"W

1:13,571

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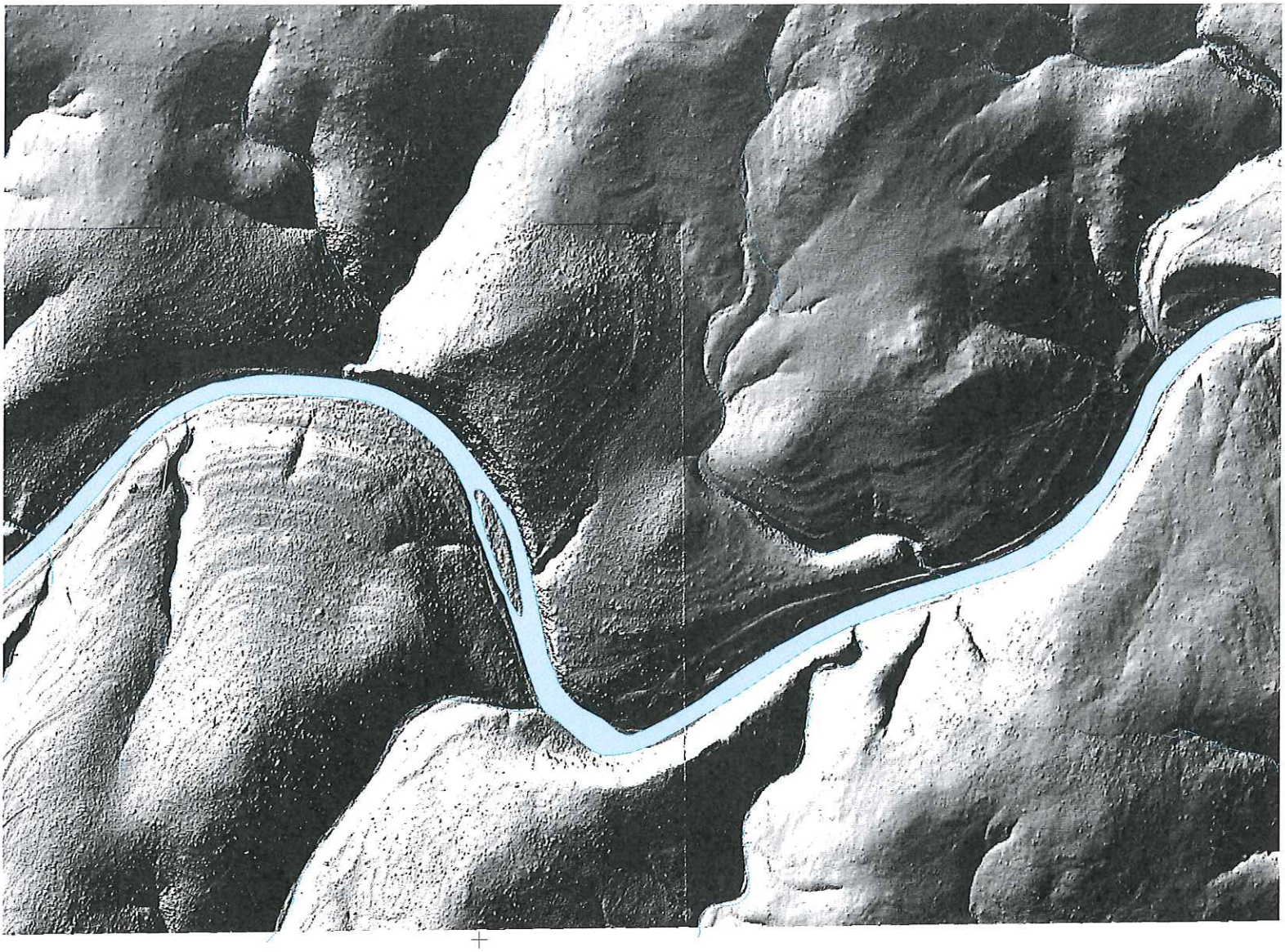

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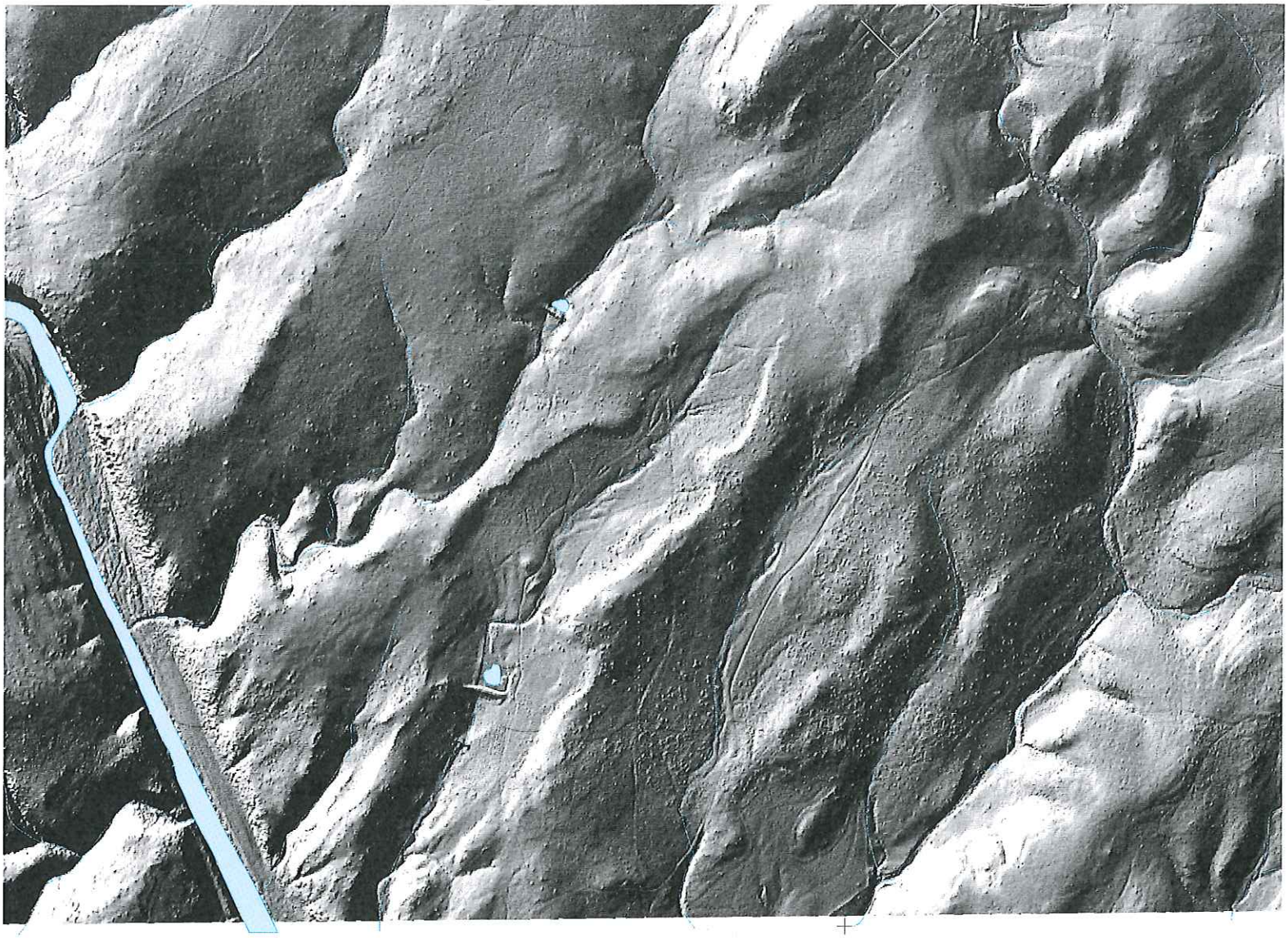

97°55'0"W

0.5 1 2 Kilometers


30°0'(
97°52'30"W