

GEOMORPHIC MAPPING OF THE CHEHALIS RIVER FLOODPLAIN, COSMOPOLIS TO PE ELL, GRAYS HARBOR, THURSTON, AND LEWIS COUNTIES, WASHINGTON

by Stephen L. Slaughter and Ian J. Hubert

WASHINGTON
DIVISION OF GEOLOGY
AND EARTH RESOURCES
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WASHINGTON STATE DEPARTMENT OF
Natural Resources
Peter Goldmark - Commissioner of Public Lands

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This map product has undergone a high level of internal agency review by geologists, cartographers, and editors.

WASHINGTON STATE DEPARTMENT OF NATURAL RESOURCES

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Geomorphic Mapping of the Chehalis River Floodplain, Cosmopolis to Pe Ell, Grays Harbor, Thurston, and Lewis Counties, Washington

by Stephen L. Slaughter and Ian J. Hubert
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MS 47007; Olympia, WA 98504-7007

SUMMARY

This map book is a visualization tool intended to assist in identification of geomorphic and anthropogenic landforms in the approximate Chehalis River 100-year floodplain. The map book delineates subtle landforms on the floodplain for a 110-mile reach of the Chehalis River between Pe Ell and Cosmopolis, Washington. The intended users of the map book include biologists, wetland scientists, land managers, property owners, geologists, botanists, floodplain managers, watershed managers, and those interested in the subtle geomorphic features of the Chehalis River floodplain. All landforms were interpreted from remote analysis of lidar and aerial imagery and no field validation was performed for any portion of this project. Note that this is not a flood prediction or flood depth map and cannot be used as such; it is only intended as a visualization tool for the geomorphology of the Chehalis River floodplain.

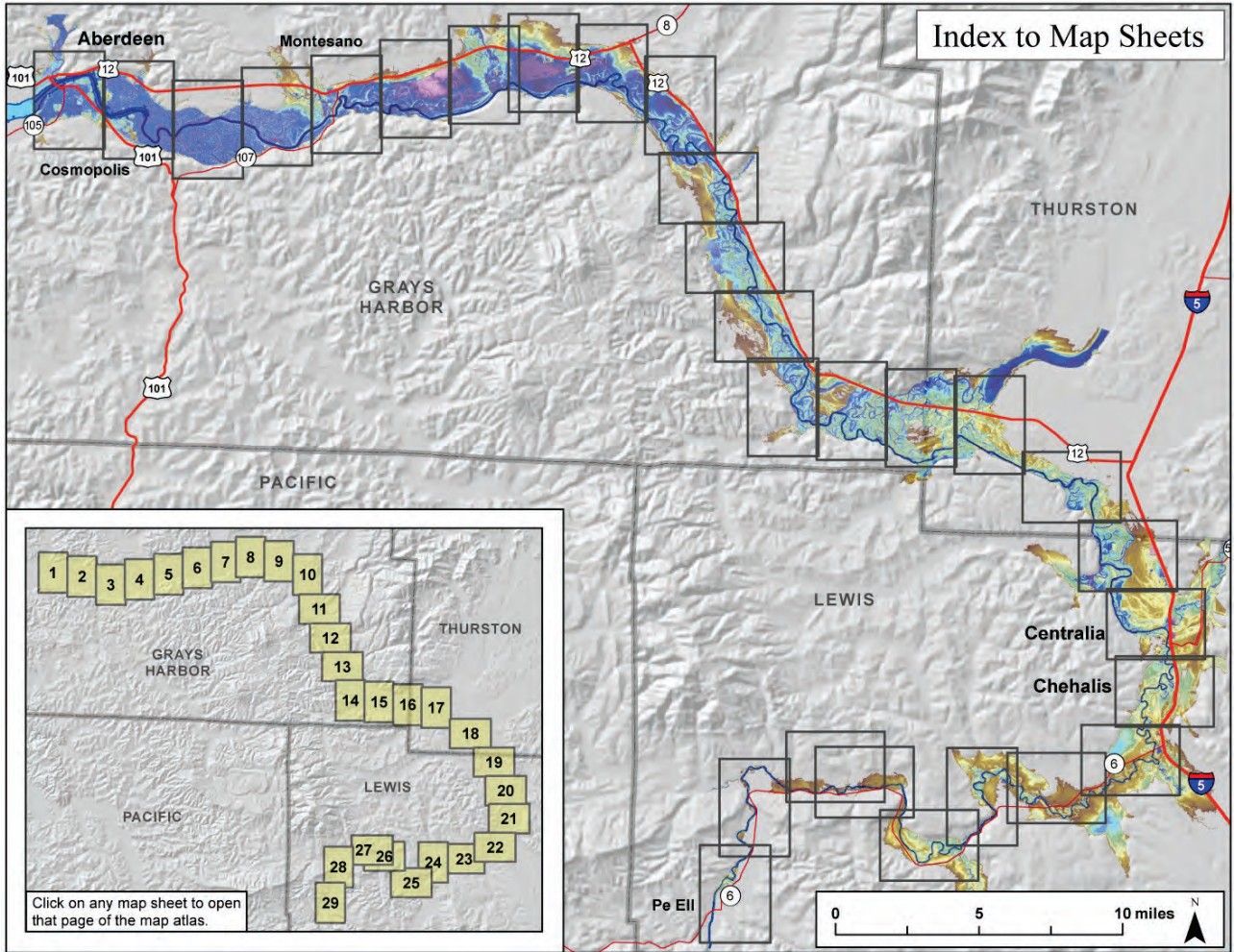
DESCRIPTION

Data was interpreted by a geologist using a geographic information system (GIS) to analyze a relative elevation model derived from 1- and 2-meter lidar digital elevation models (DEMs) and 12-inch-resolution aerial images from 2011. These maps are relative elevation models (REMs) that represent the elevation of features on a floodplain relative to the Chehalis River's water surface by removing downstream changes in elevation associated with the channel gradient, a process termed 'detrending' (Wash. Dept. of Ecology, unpublished documents, 2013). Essentially, the elevation of the river between Pe Ell and Cosmopolis was adjusted to 0 feet, and the elevation of the features adjacent to the river were also reduced by a similar elevation. This visualization method reveals subtle changes in floodplain elevation, specifically geomorphic features within the floodplain, such as abandoned channels, ditches, stream channels, roads, and other natural and anthropogenic features. In this map book, features include lines that delineate primary channels, secondary channels, sloughs, swales, elevated grades, natural levees, and artificial levees. The final three mapped landforms (elevated grades, natural levees, and artificial levees) are raised features on the floodplain that exceed approximately 1-foot elevation above the adjacent floodplain. Primary and secondary channels, slough, and swale landforms are incised features or depressions in the floodplain that exceed approximately 1-foot elevation below the adjacent floodplain.

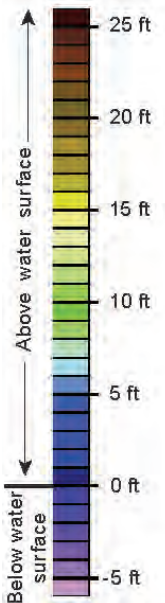
DEFINITIONS OF THE GEOMORPHIC LANDFORMS

Because this project was limited to reconnaissance mapping techniques, there was no detailed field validation of landforms. Therefore, we used broad landform categories to encapsulate geomorphic and anthropogenic features. For instance, any raised and elongate feature with an elevation approximately 1 foot above the floodplain (both modern and abandoned) and not used as a transportation network (paved road, gravel road, railroad line, etc.) is categorized as an 'artificial levee'. There may be cases where poor lidar returns will show dense, stream-adjacent brush as an elevated feature that resembles an artificial levee, and the feature will likely be mapped as such. These are considered acceptable errors for reconnaissance mapping. Below are descriptions of the landforms identified on the floodplain and other terms used in this report.

- **Cut-off.** An abandoned meander bend that has been short-circuited by the river flow. Cut-offs become infilled over time by a process of abandoned-channel accretion. For these maps, the terms ‘cut-off’ and ‘oxbow lake’ may be used interchangeably due to difficulties in observing surface water in aerial imagery.
- **Ditch.** An artificial, typically linear excavation used to aid in drainage and movement of surface water. Ditches are typically linear whereas natural stream channels are sinuous; however, there may be occasions where the two are difficult to discern and so the terms may be used interchangeably.
- **Flood channel.** A channel that bypasses the main channel during flooding. Flood channels are typically relatively straight, have a lesser depth than the main channel, and remain dry for much of the year, only becoming filled with water as flow approaches bankfull or channel capacity.
- **Grade, elevated.** Any transportation network constructed on fill above the floodplain, including highways, secondary roads, gravel roads, railroads, etc. They can be either in use or abandoned. Road beds must be elevated at least 1 foot above the adjacent floodplain to be included.
- **Levee, artificial.** Any linear feature constructed above the floodplain that does not act as a transportation network (see *Grade, elevated*). Artificial levees are typically broad at the base and taper with height. These elongate features may be several miles long or very short and simply encircle a structure in the floodplain. Levees may be used for flood defense to increase channel capacity at high flows
- **Levee, natural.** An elongated, raised ridge formed at the channel–floodplain boundary during overbank flow. The height of a levee is scaled to the size of the channel, and its presence implies a relatively stable channel location. Note that what appears to be a levee on the lidar may actually be dense vegetation impenetrable to lidar. This is particularly likely in Thurston County, where bare-earth lidar returns are very poor in places with tree canopy because the lidar was collected during deciduous leaf-on conditions.
- **Lidar.** An acronym for Light Detection and Ranging, a remote-sensing method that uses light from a pulsed laser to measure the distance to the Earth’s surface. When combined with other data recorded by the airborne system, it can generate precise, three-dimensional information about the ground surface.
- **Meander scroll bar.** A former point-bar deposit that now appears as ridge-and-swale topography at the location of the former point bar.
- **Oxbow lake.** A lake, typically U-shaped, formed by an abandoned meander bend (cut-off). For these maps, the terms ‘cut-off’ and ‘oxbow lake’ may be used interchangeably due to difficulties in observing surface water in aerial imagery.
- **Paleochannel.** A longer section of an abandoned channel that may exhibit a wide range of different shapes on the map. Paleochannels gradually become infilled by abandoned-channel accretion; the degree of infilling reflecting the age of the channel. The rate of infilling is dependent on factors such as the geometry of the paleochannel and its position on the floodplain in relation to overbank deposits.
- **Primary channel.** The Chehalis River channel from Pe Ell to Cosmopolis, delineated using lidar bare-earth hillshades.
- **Secondary channel.** Any stream channel or ditch that could transport surface water to the Chehalis River.
- **Slough.** A seasonally inundated, active channel or floodplain depression typically not connected with the primary channel at low flow, including oxbow lakes and flood channels.
- **Stream channel.** Any secondary stream that flows into the Chehalis River. Ditches are typically linear whereas natural stream channels are sinuous; however, there may be occasions where the two are difficult to discern and so the terms may be used interchangeably.
- **Swale.** An active channel or floodplain depression that is disconnected from the primary channel at low flows, but inundated at highest flows. This landform includes cut-offs, meander scroll bars, and paleochannels.



Relative Elevation



Primary Landforms

-  Primary channel
-  Secondary channel
-  Slough
-  Swale
-  Elevated grade
-  Artificial levee
-  Natural levee
-  County boundary
-  Highway

Map Index. Area of geomorphic mapping of the Chehalis River floodplain between Pe Ell and Cosmopolis showing relative elevation and areas of detailed figures (black boxes) in the following map book. Two types of maps are provided for each numbered map area: the first map contains interpreted geomorphic features; the second map shows the relative elevation model. If viewing digitally, click the numbered yellow boxes on the inset map (above) to navigate to the corresponding Map Sheets in the map book. The link provided on the top of each map book page navigates back to the Map Index.

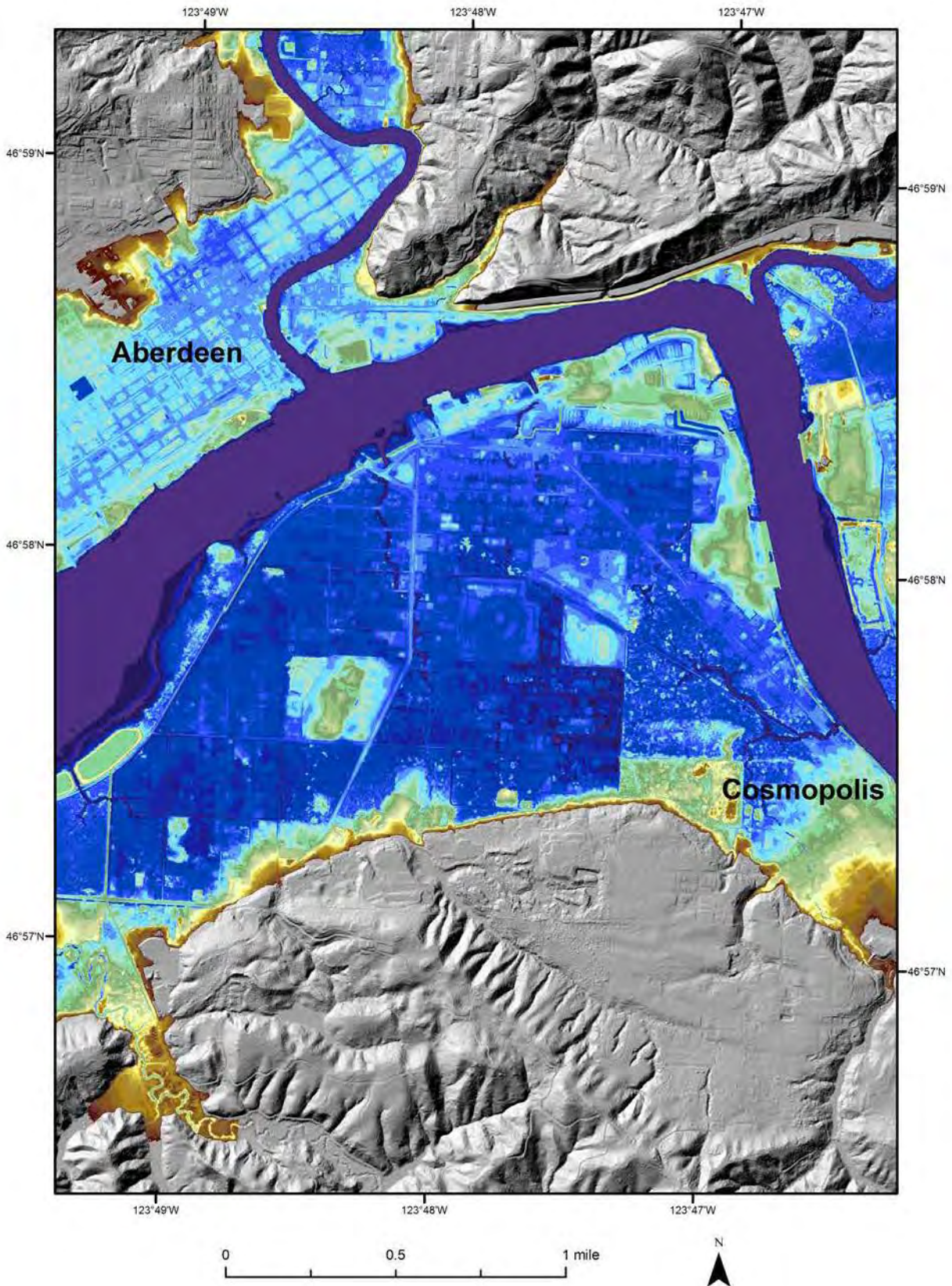
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Geomorphic Features - Map Sheet no. 1



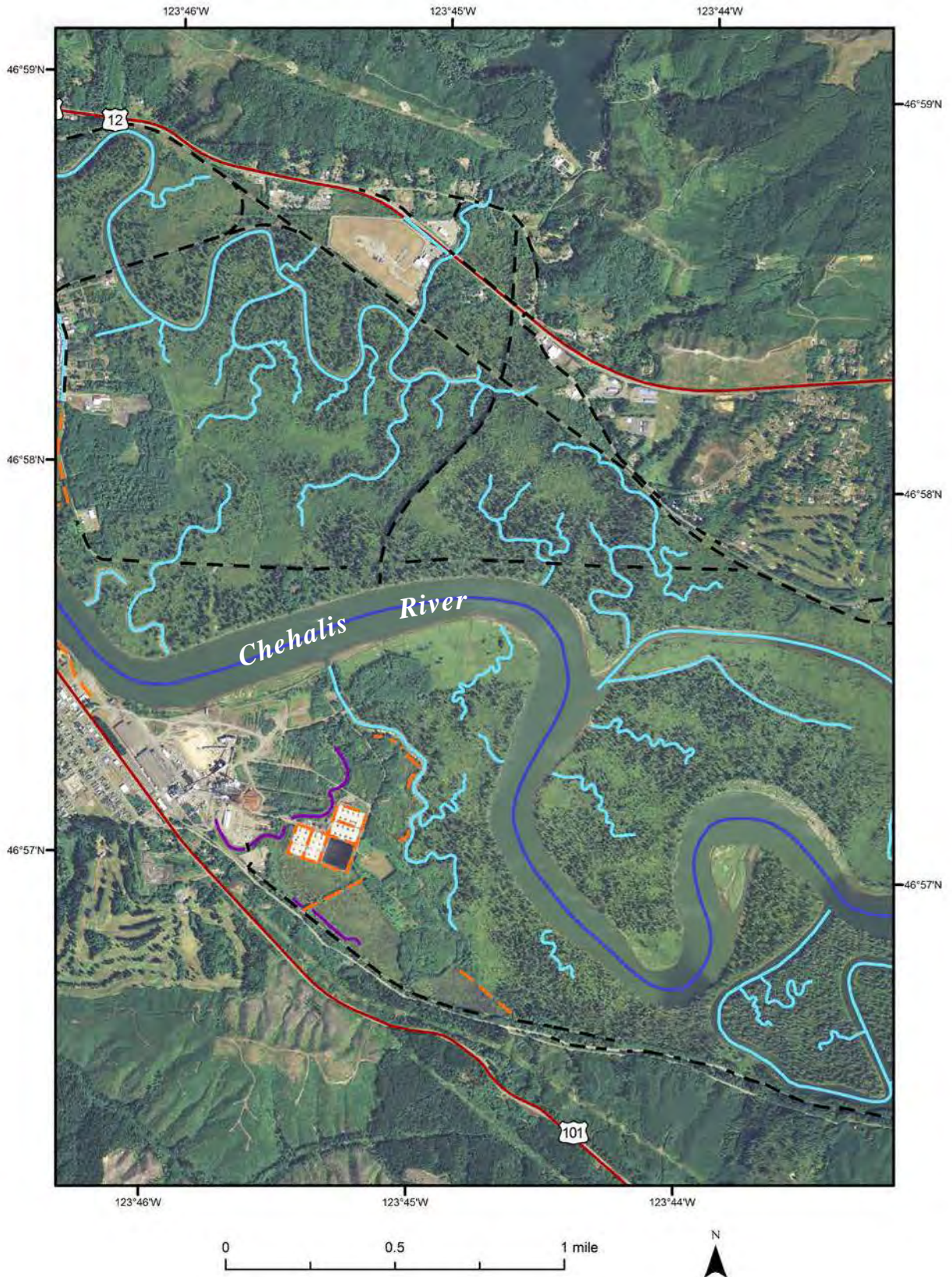
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Relative Elevation Model - Map Sheet no. 1



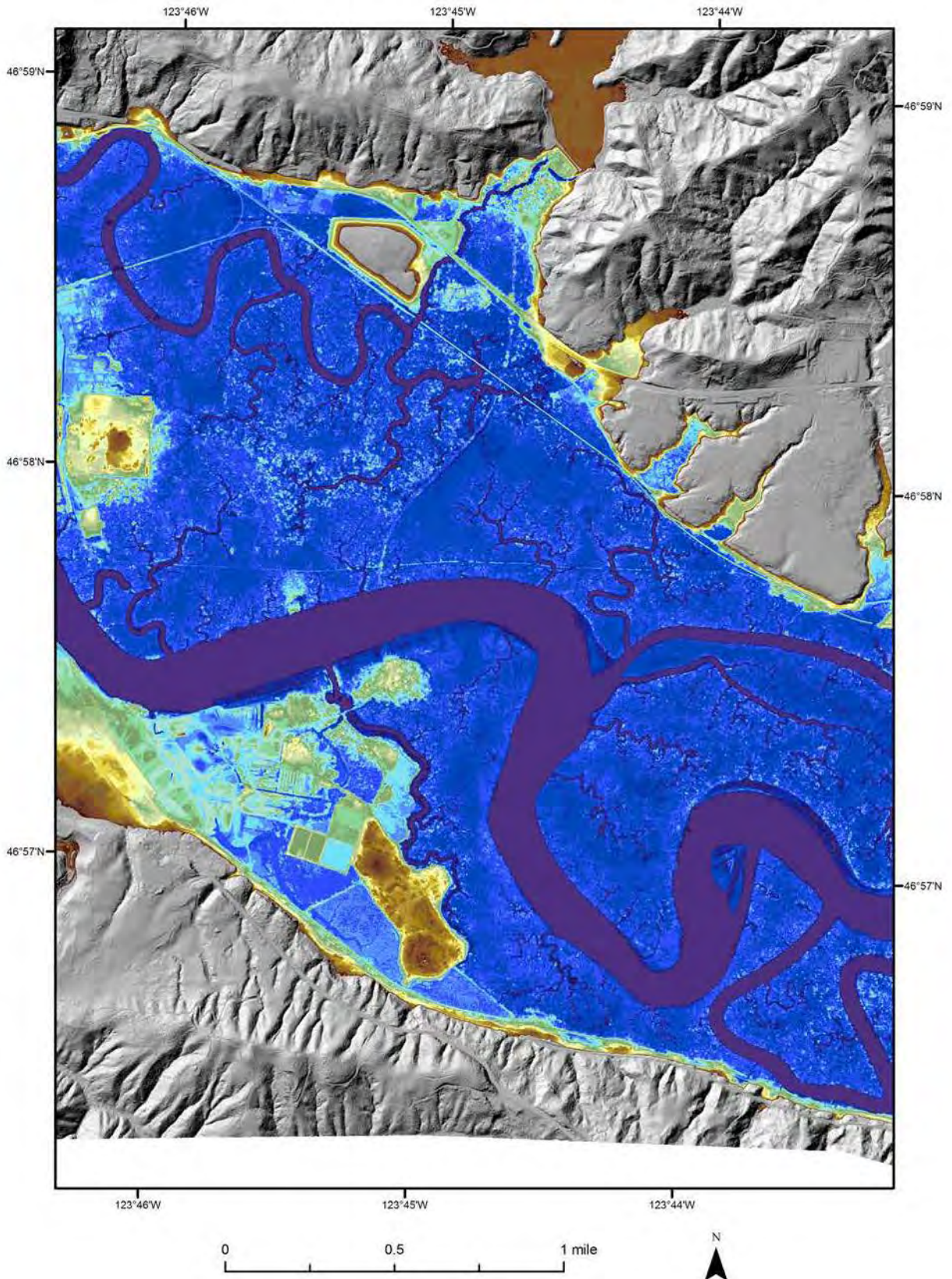
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Geomorphic Features - Map Sheet no. 2



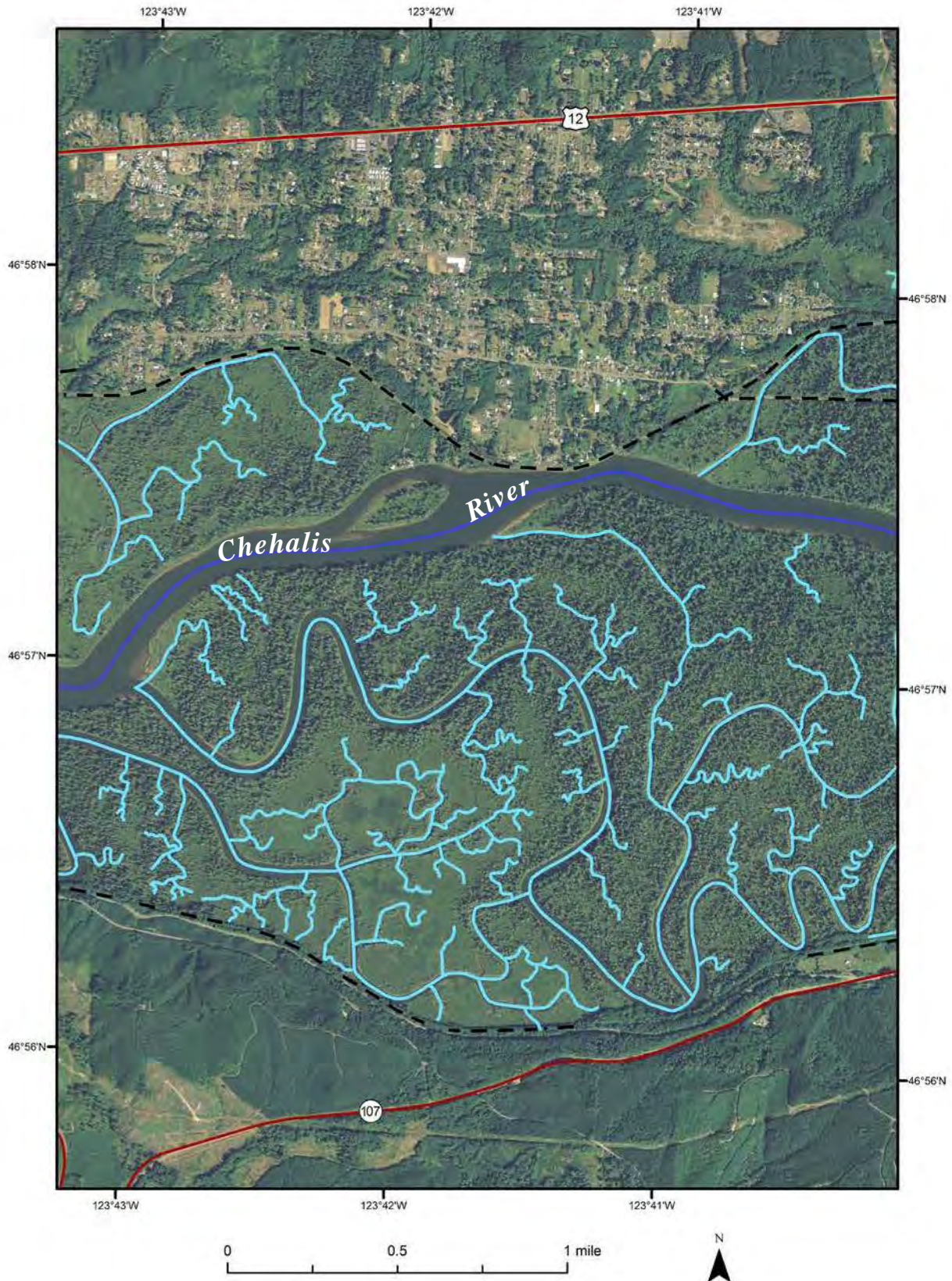
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Relative Elevation Model - Map Sheet no. 2



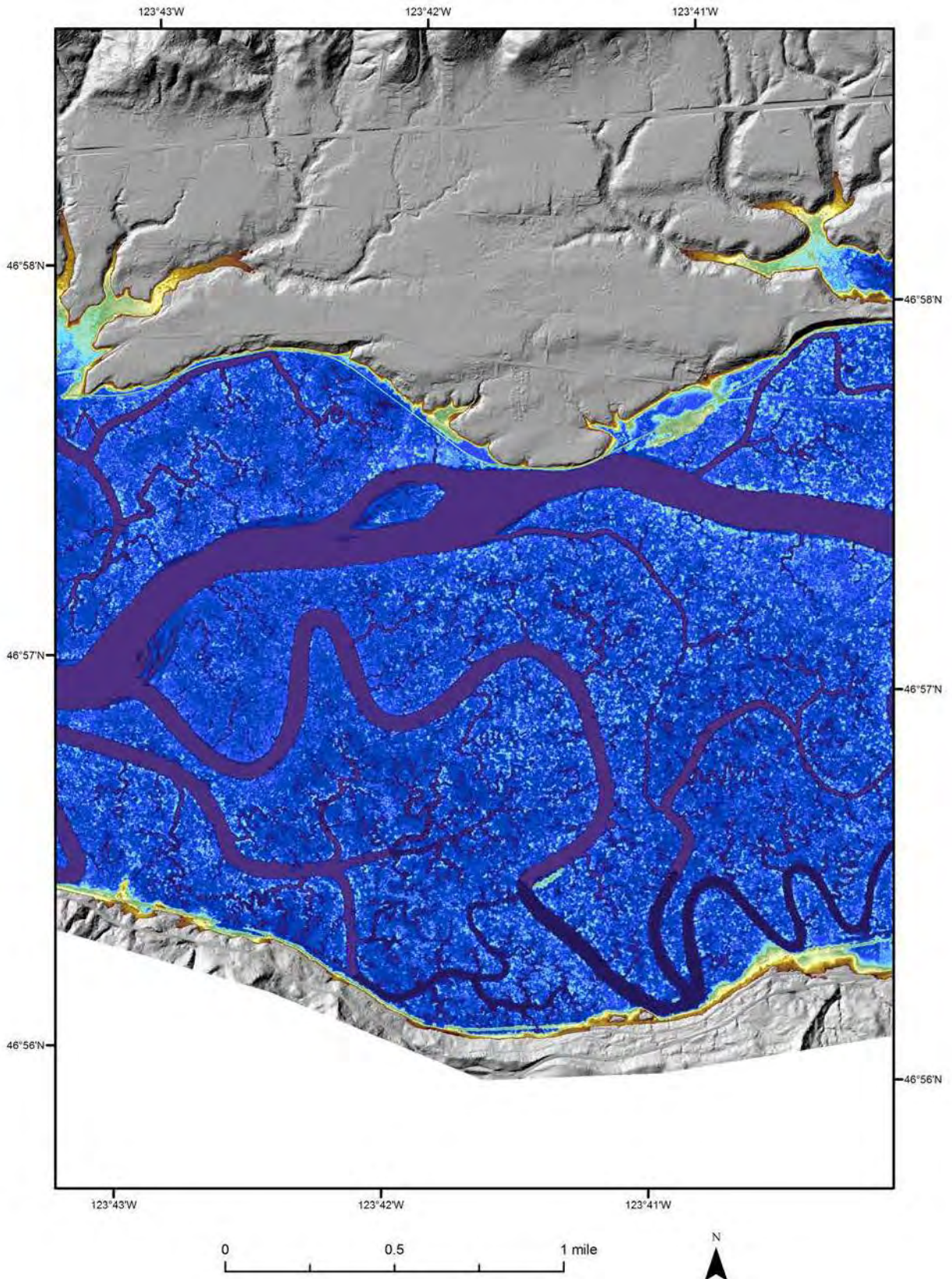
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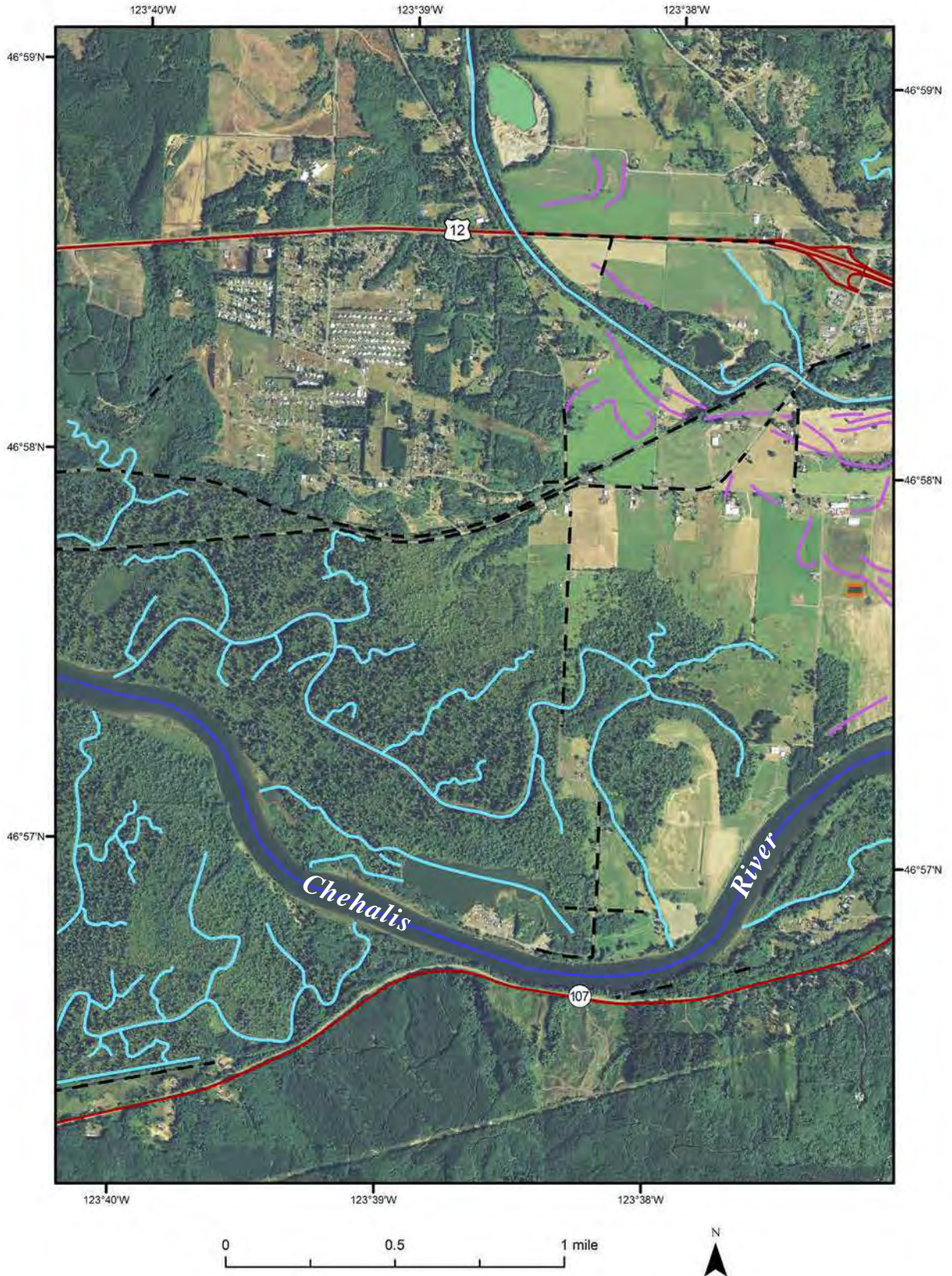
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Relative Elevation Model - Map Sheet no. 3



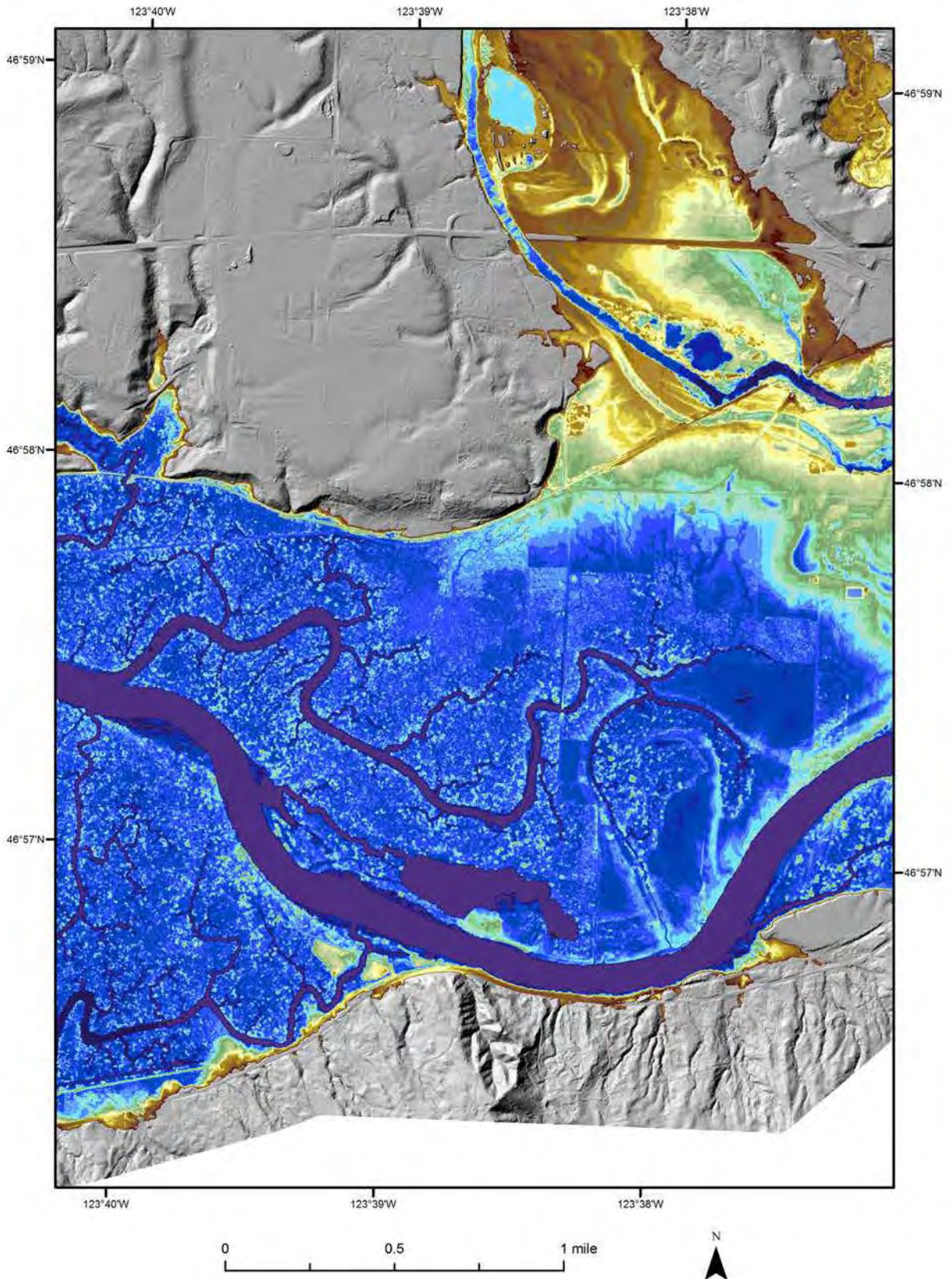
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Geomorphic Features - Map Sheet no. 4



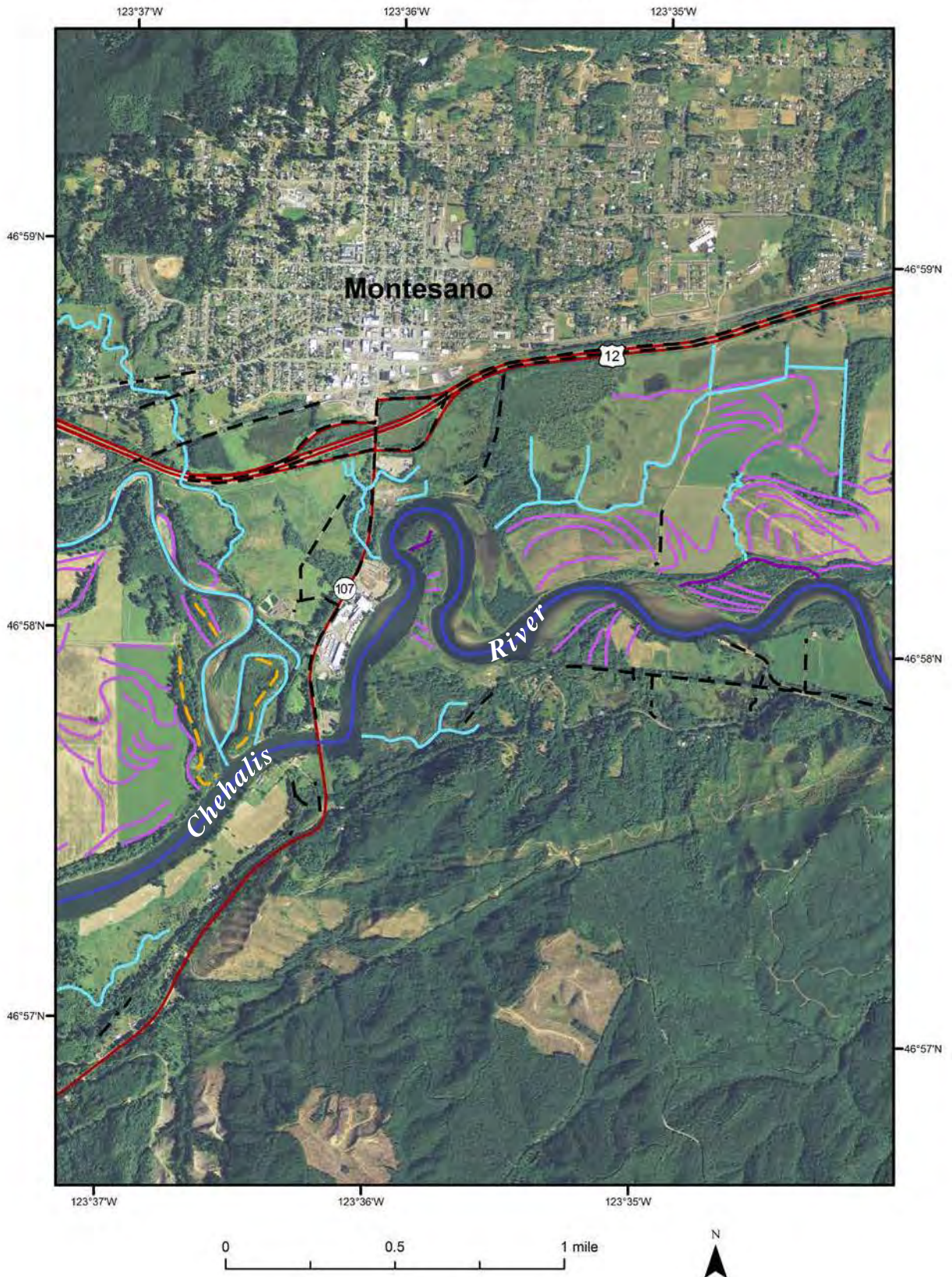
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Relative Elevation Model - Map Sheet no. 4



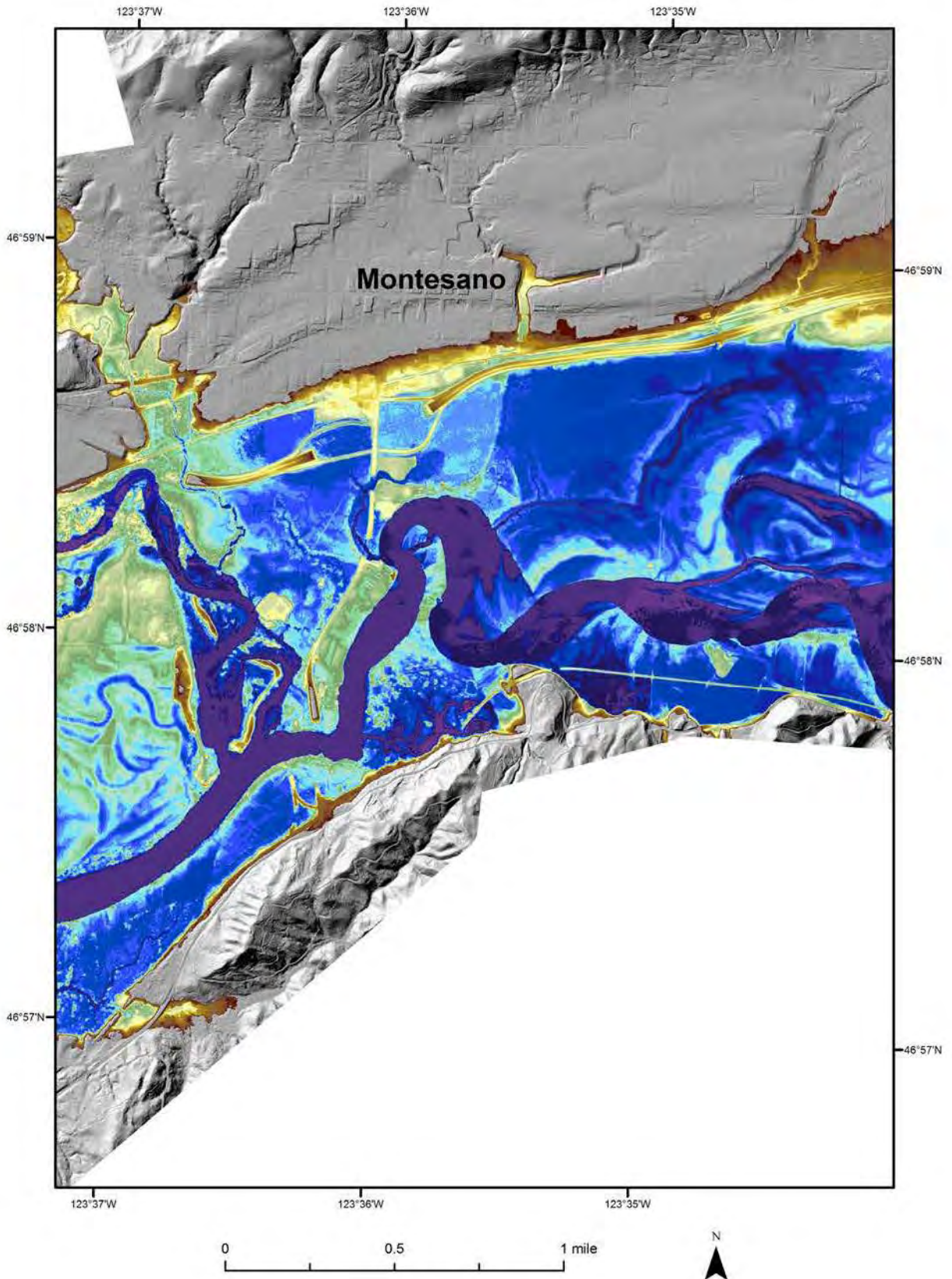
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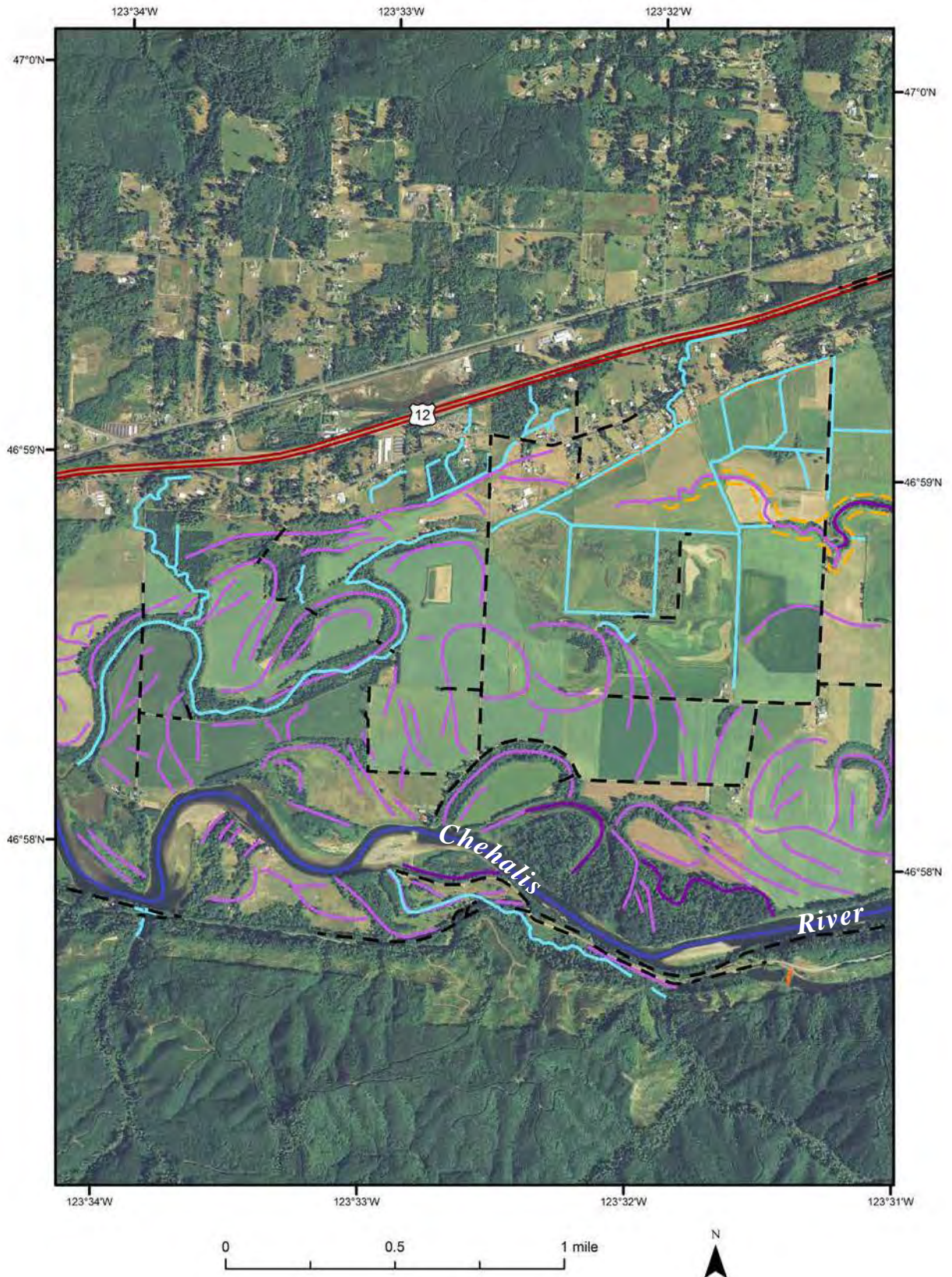
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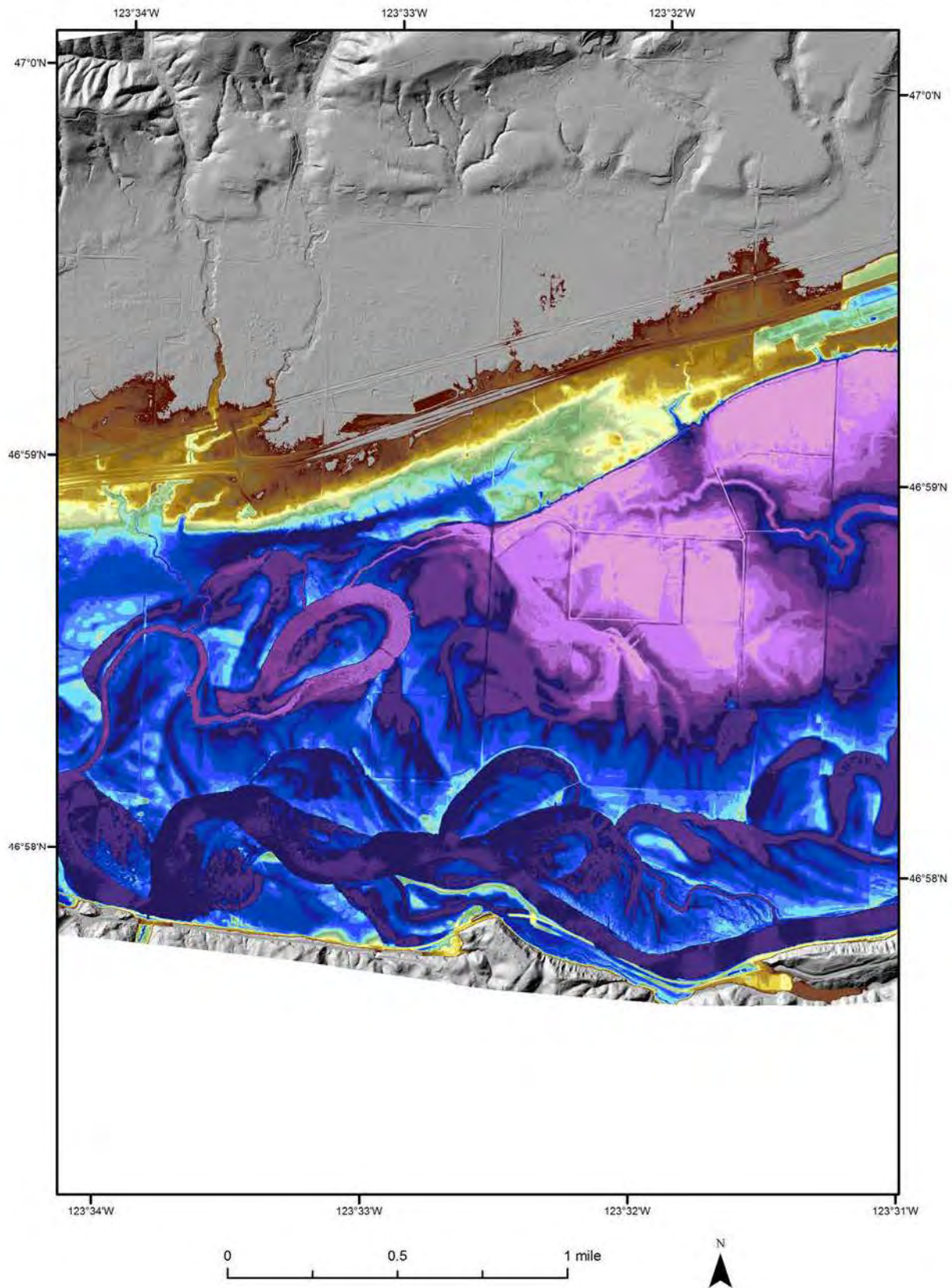
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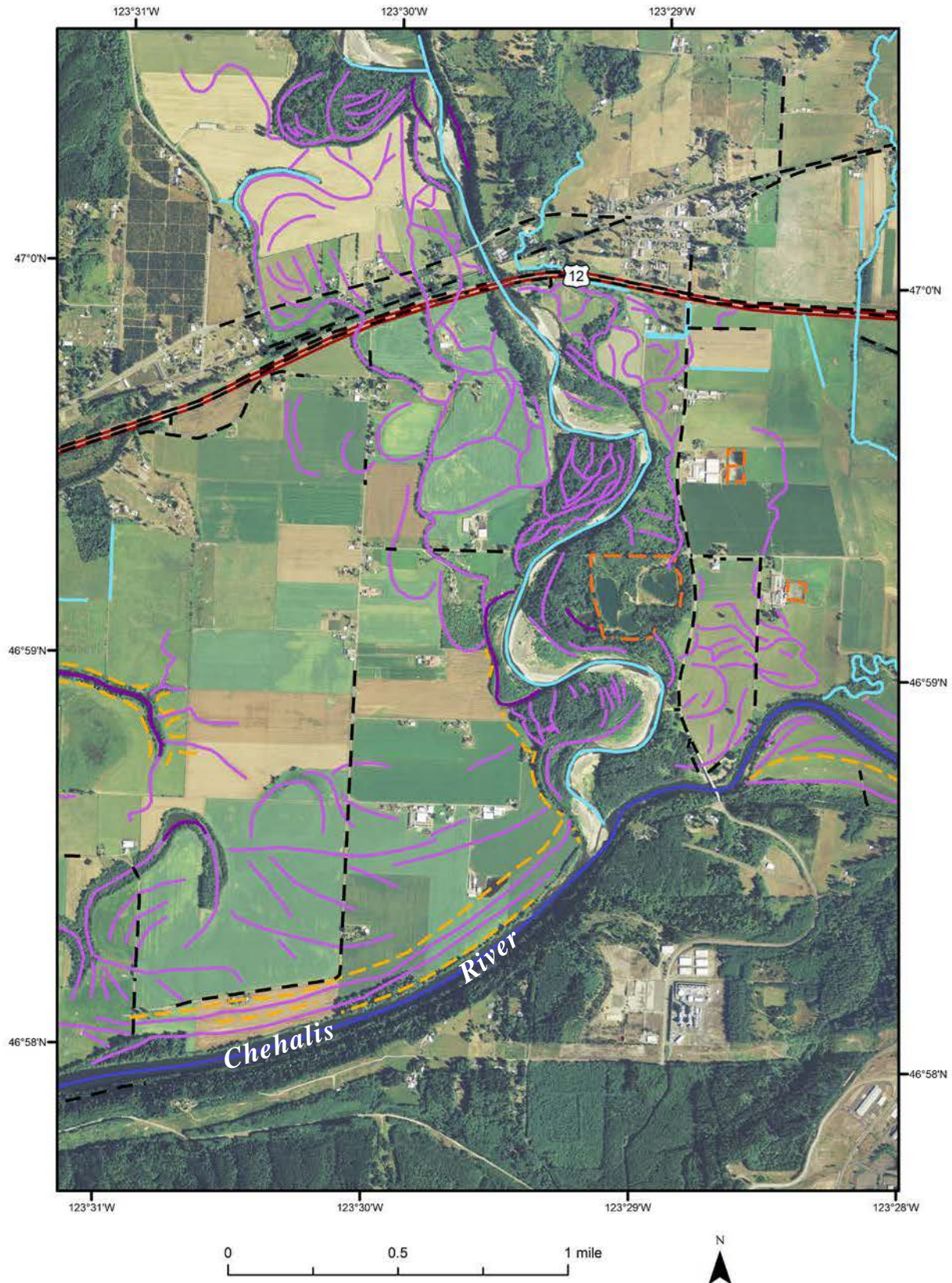
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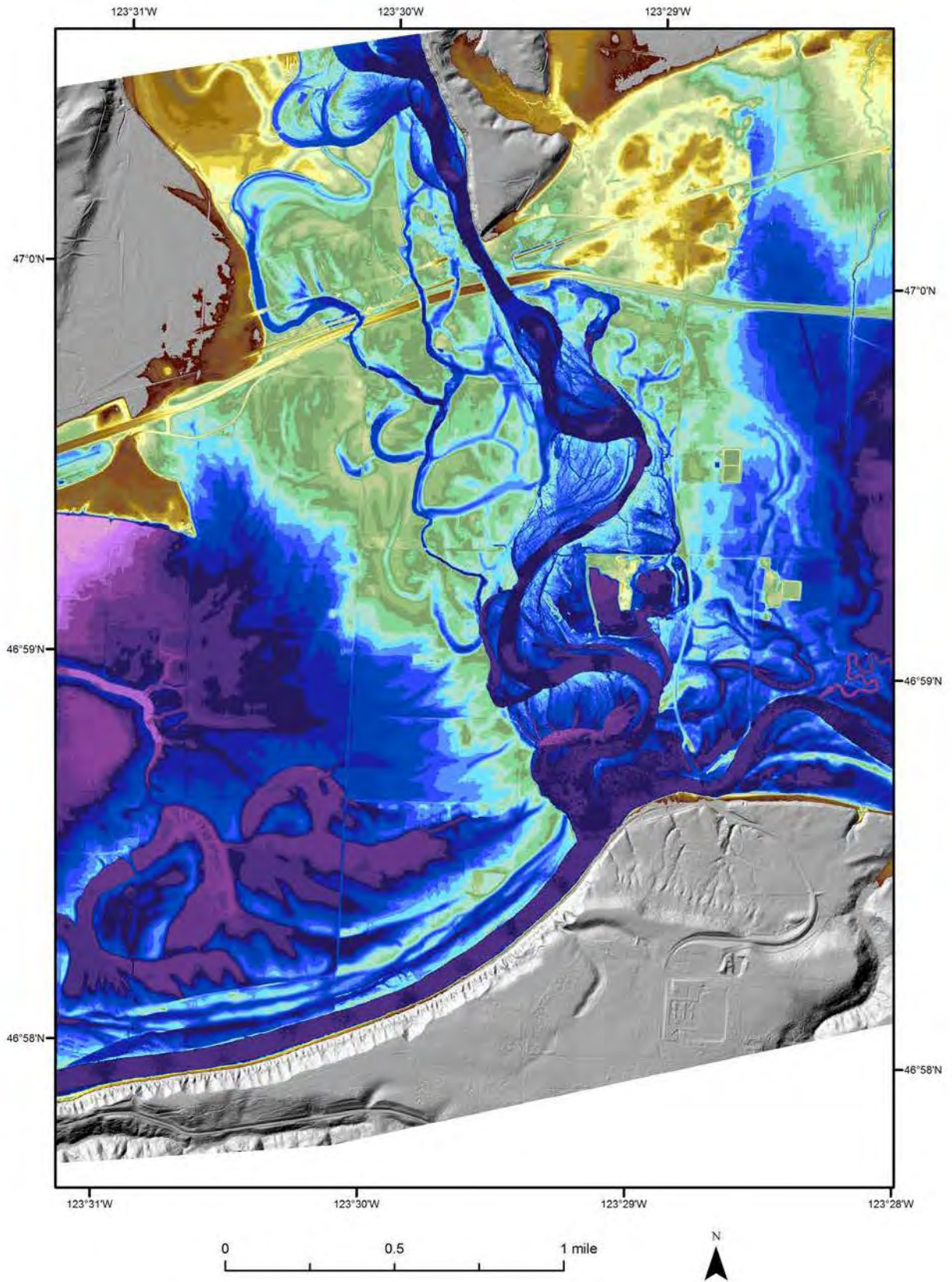
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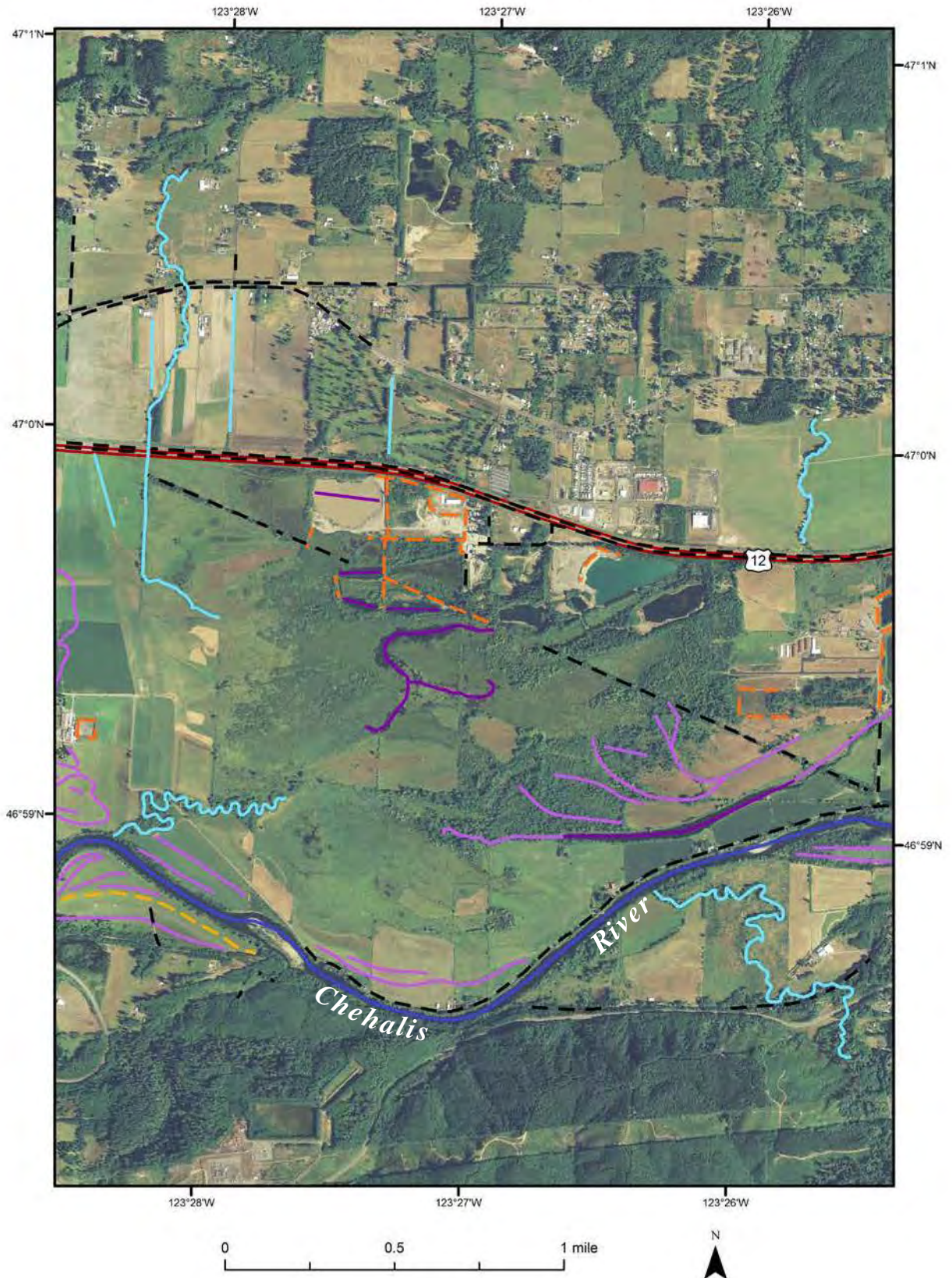
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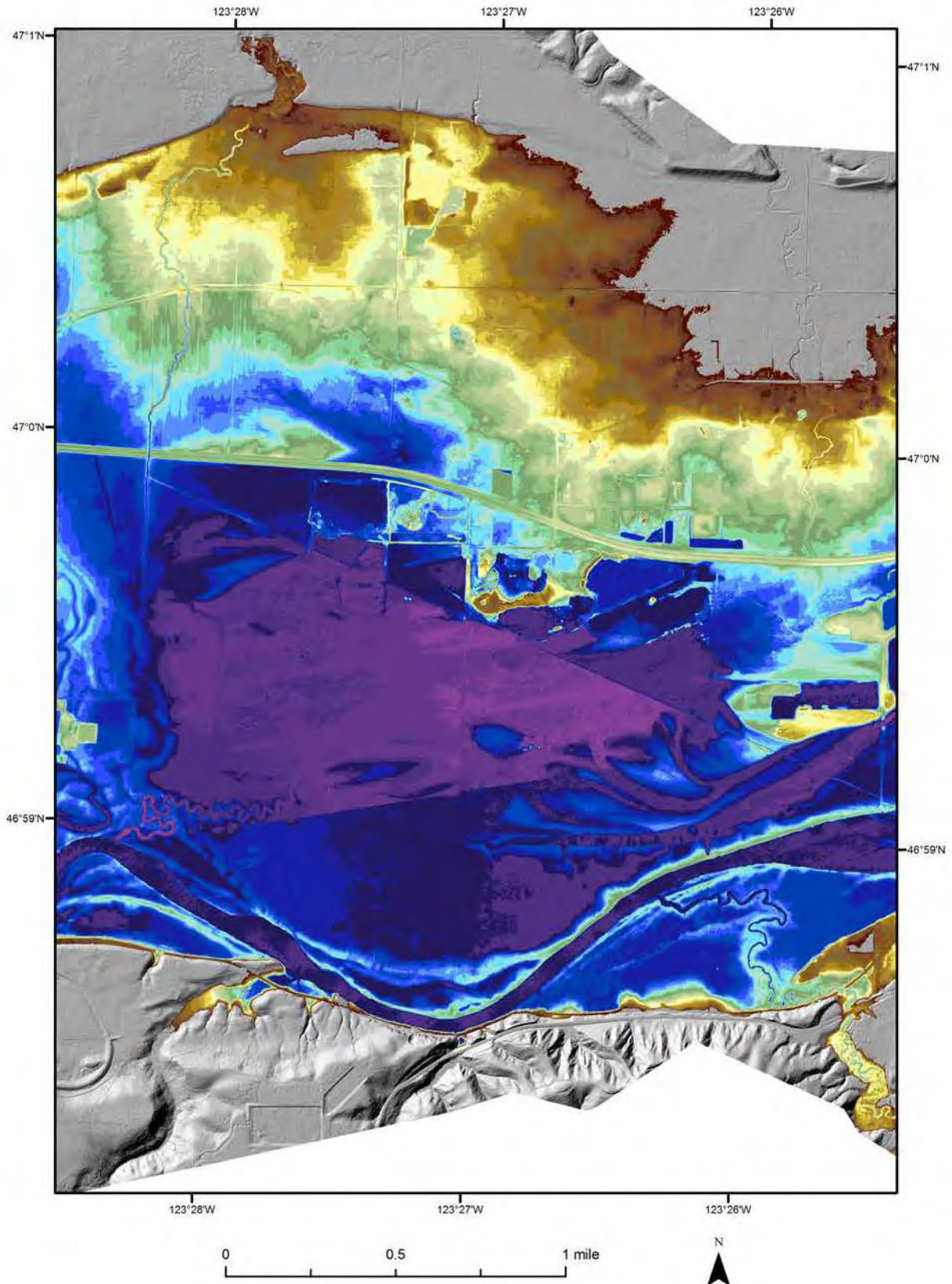
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Geomorphic Features - Map Sheet no. 8



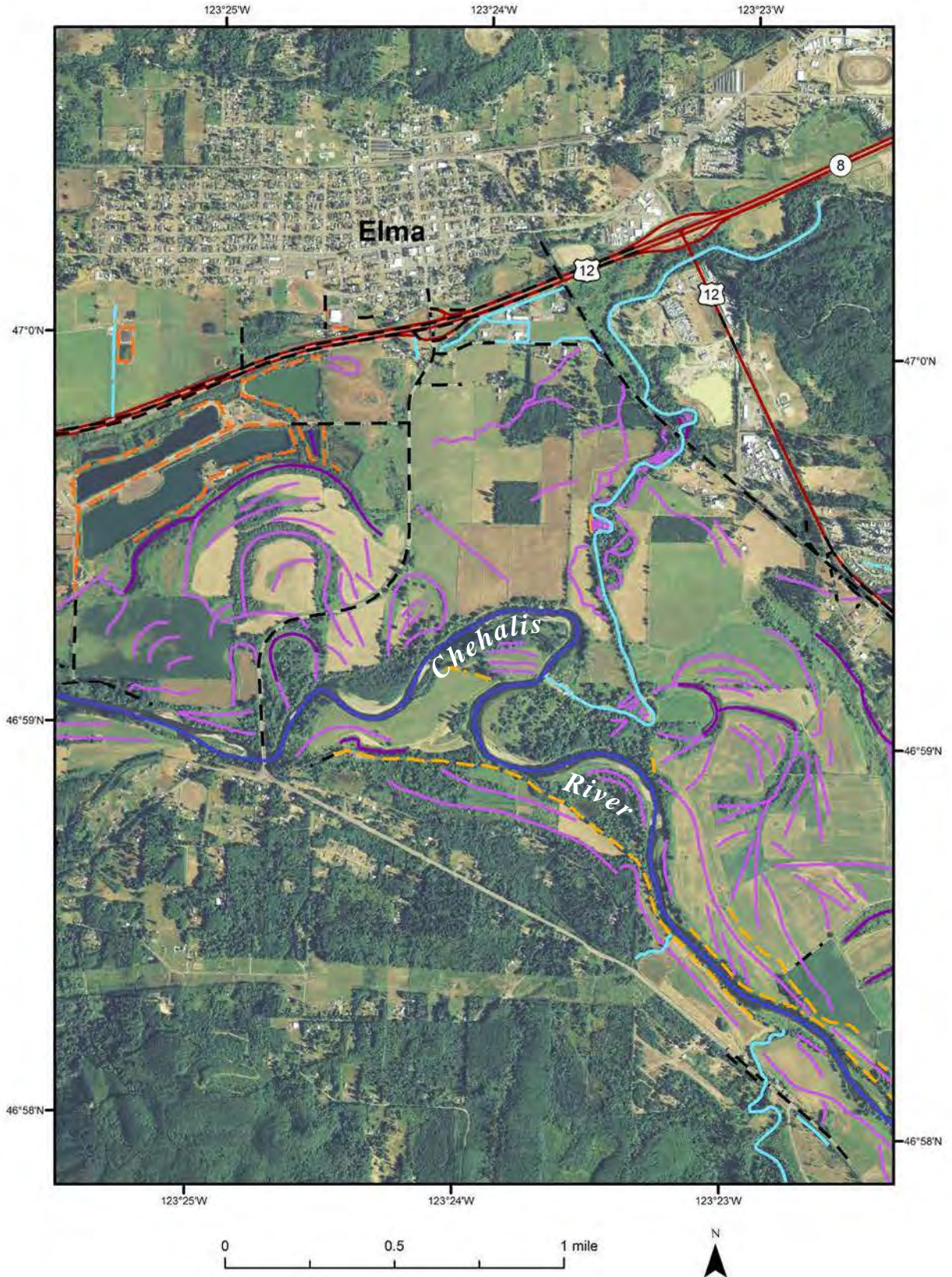
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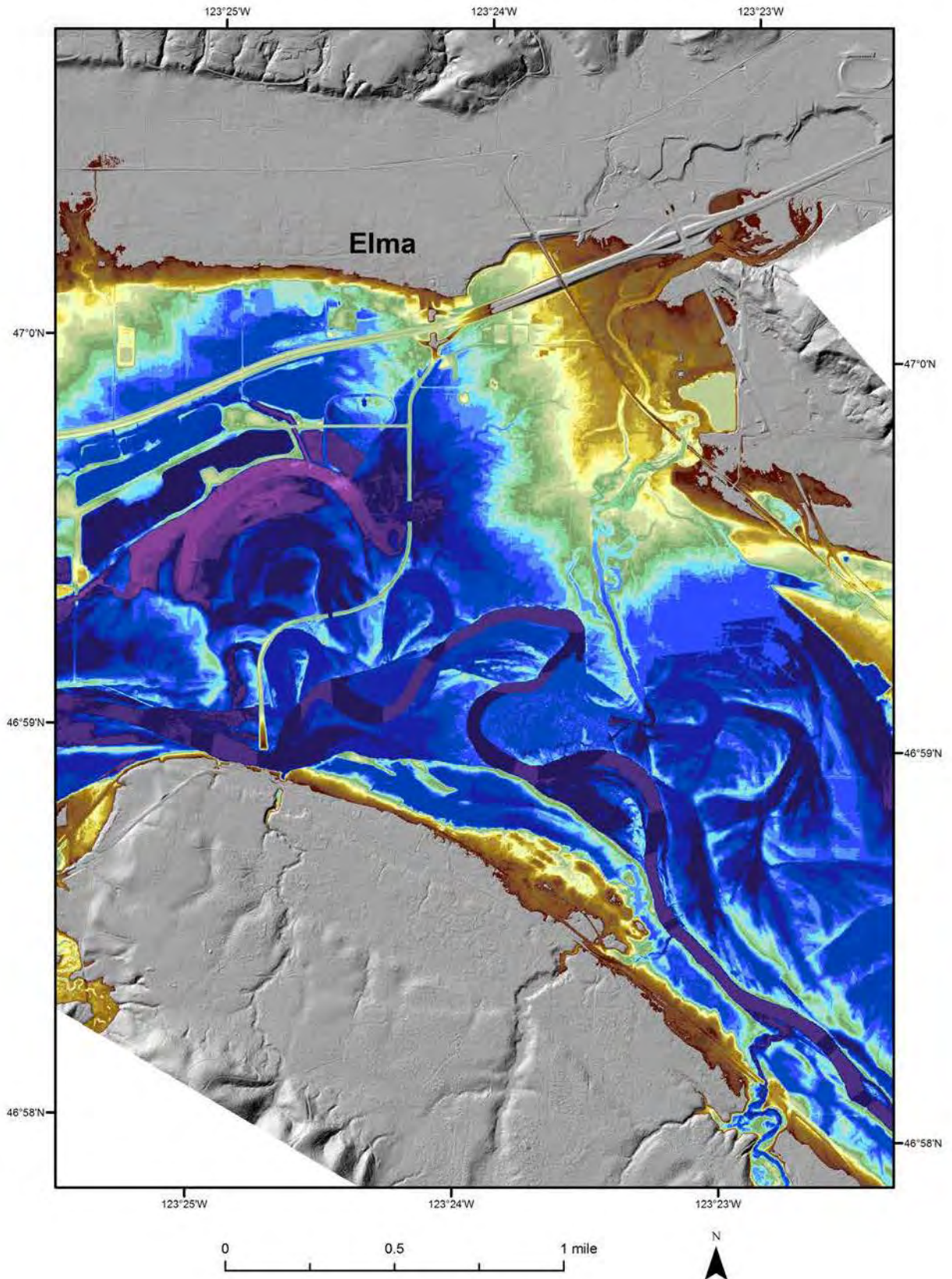
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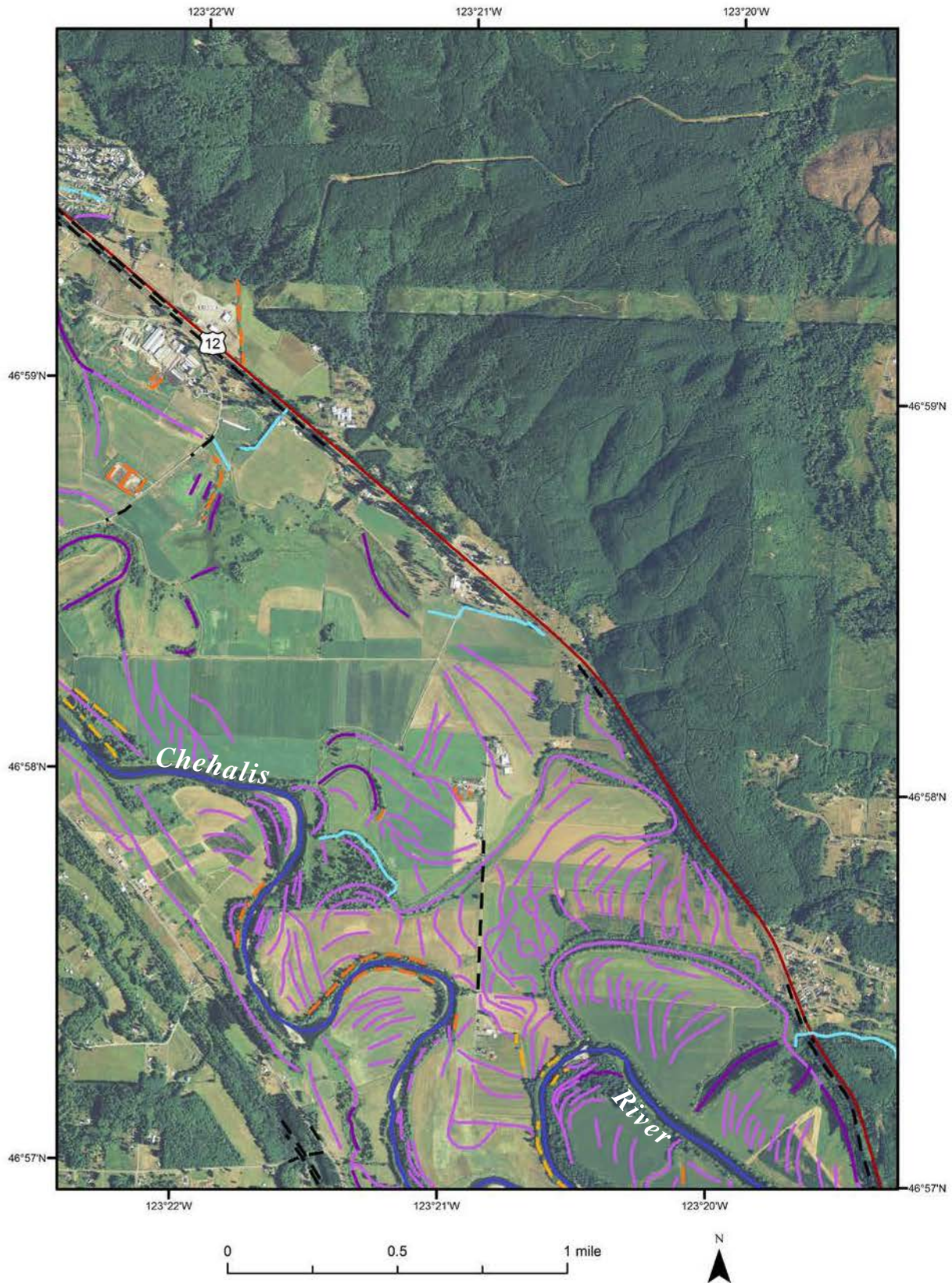
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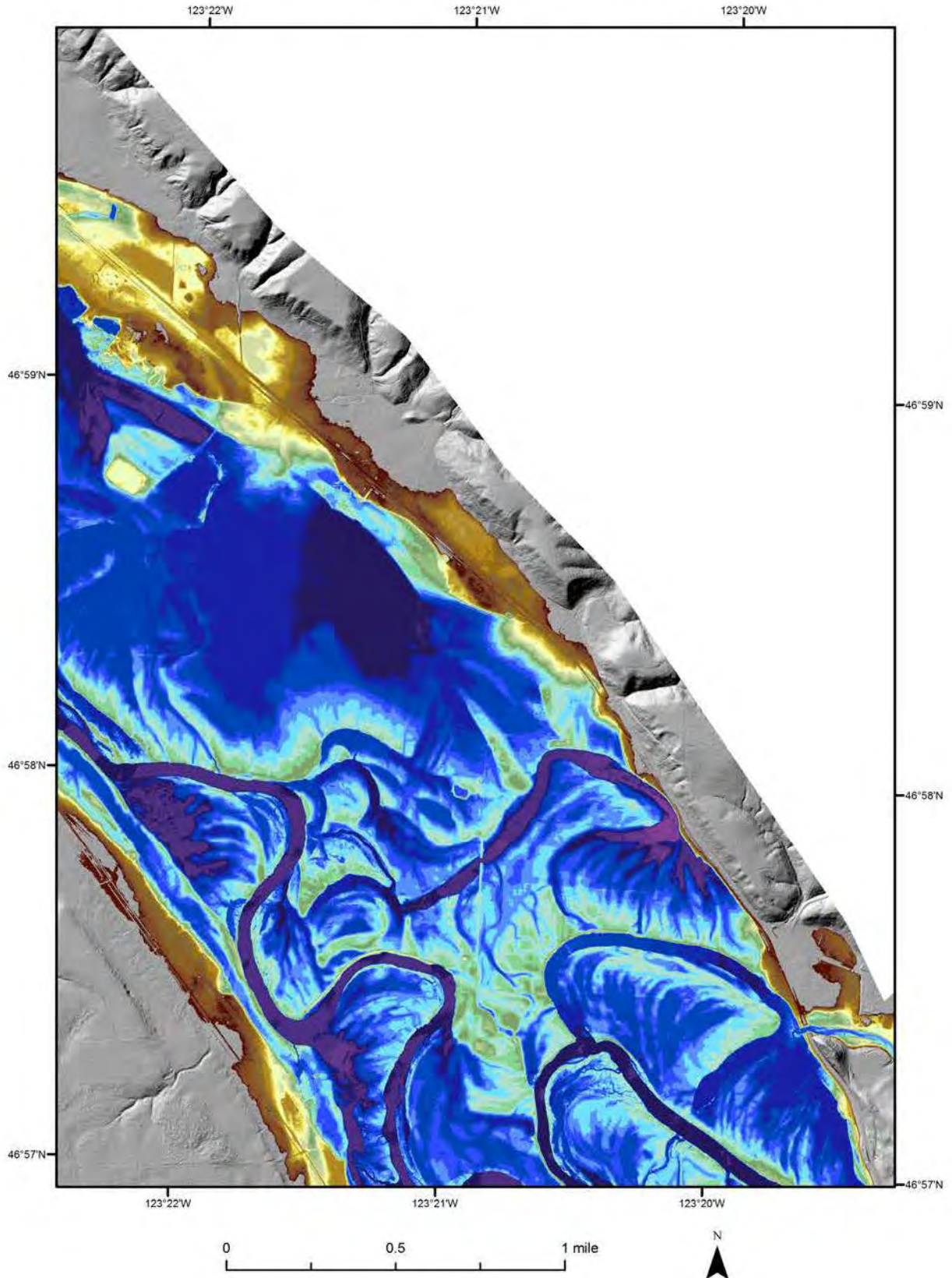
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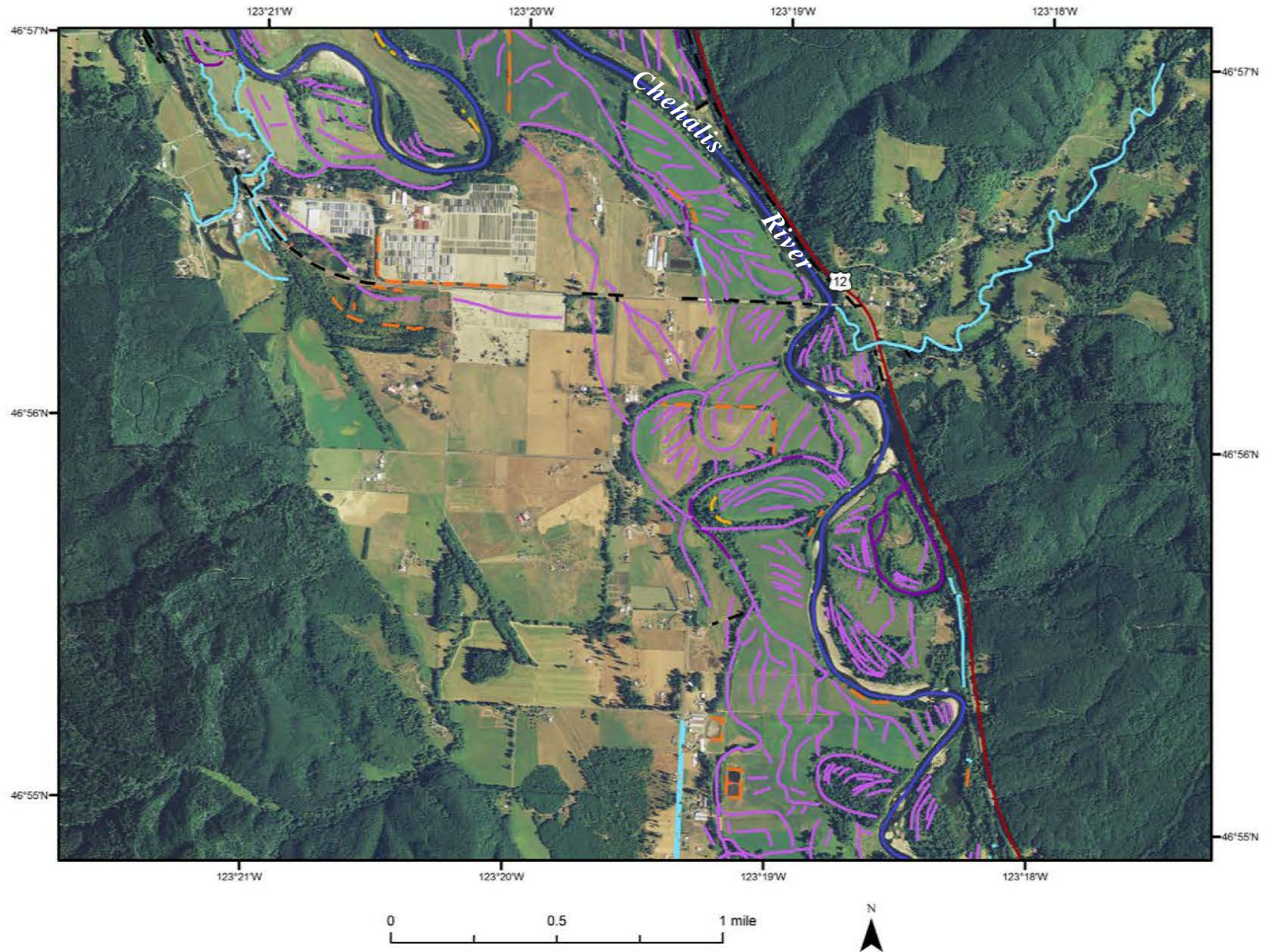


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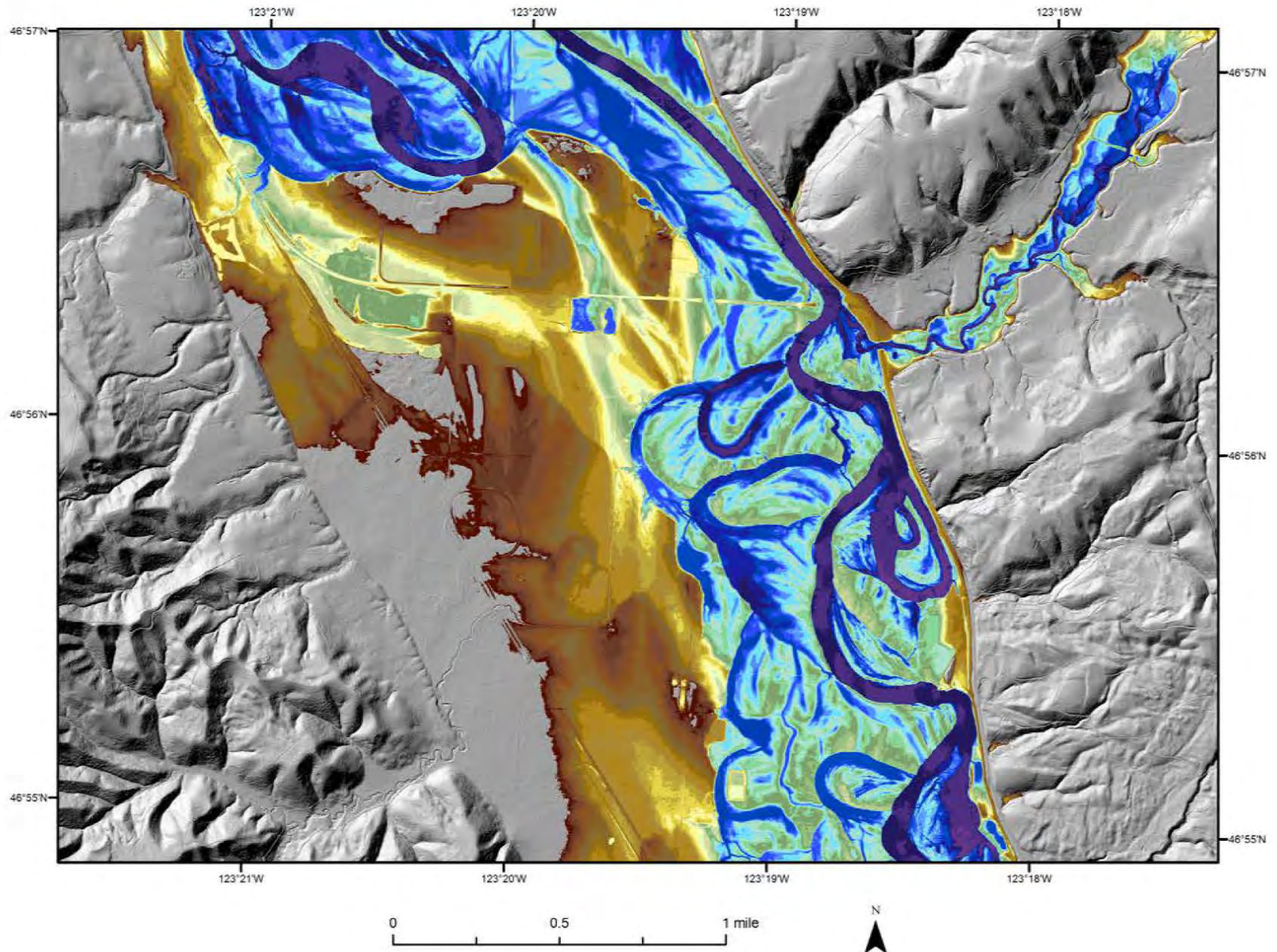


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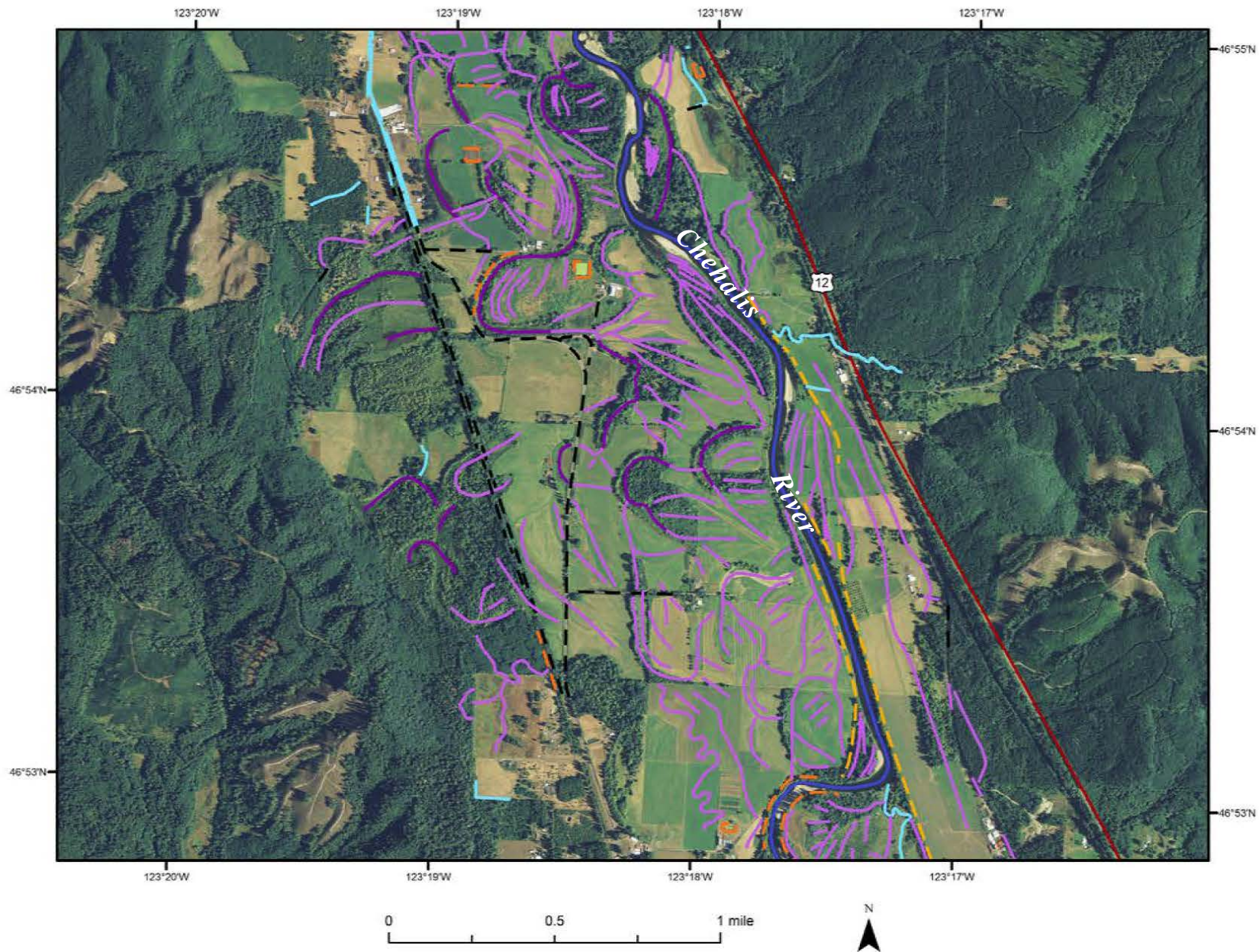
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Relative Elevation Model - Map Sheet no. 11



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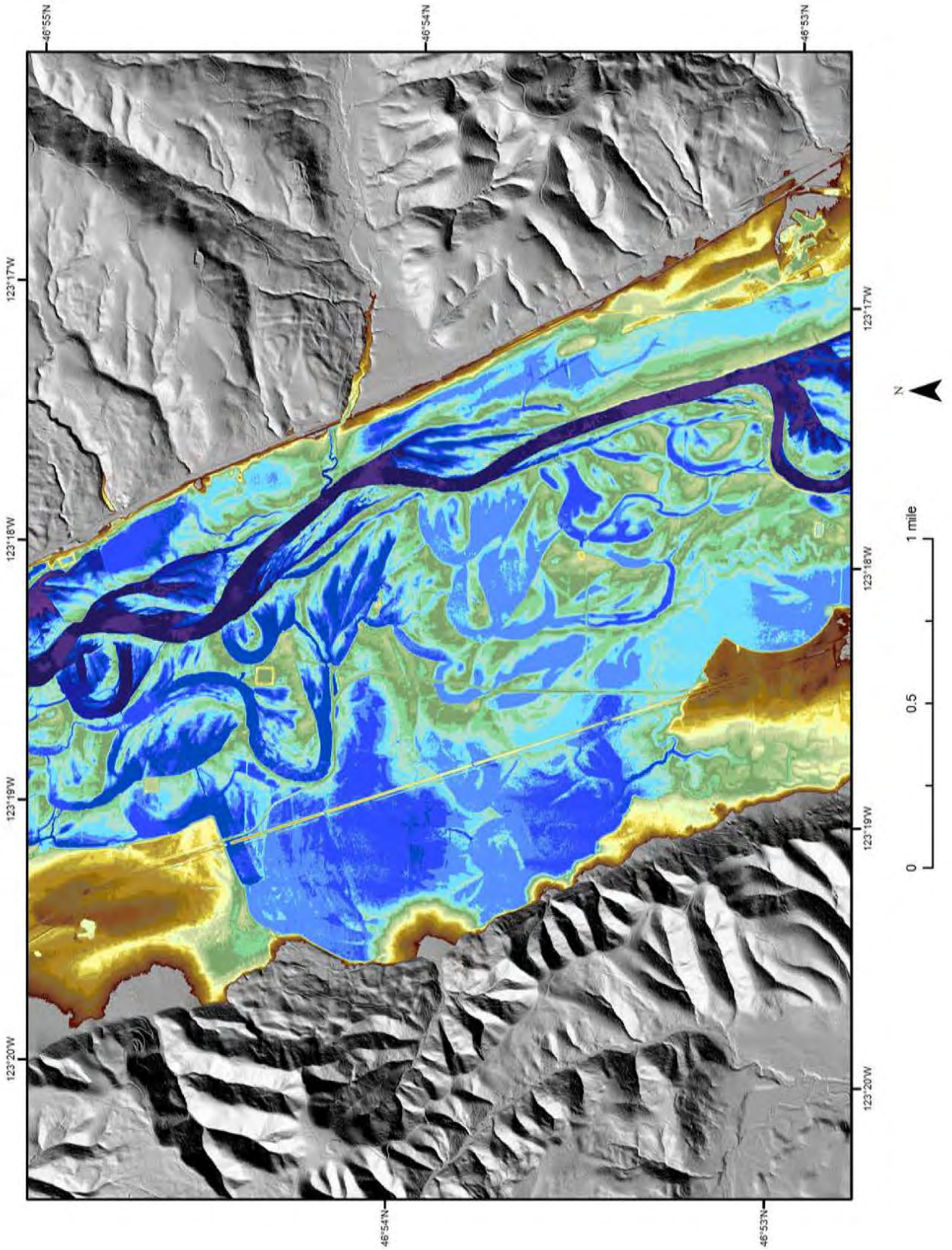
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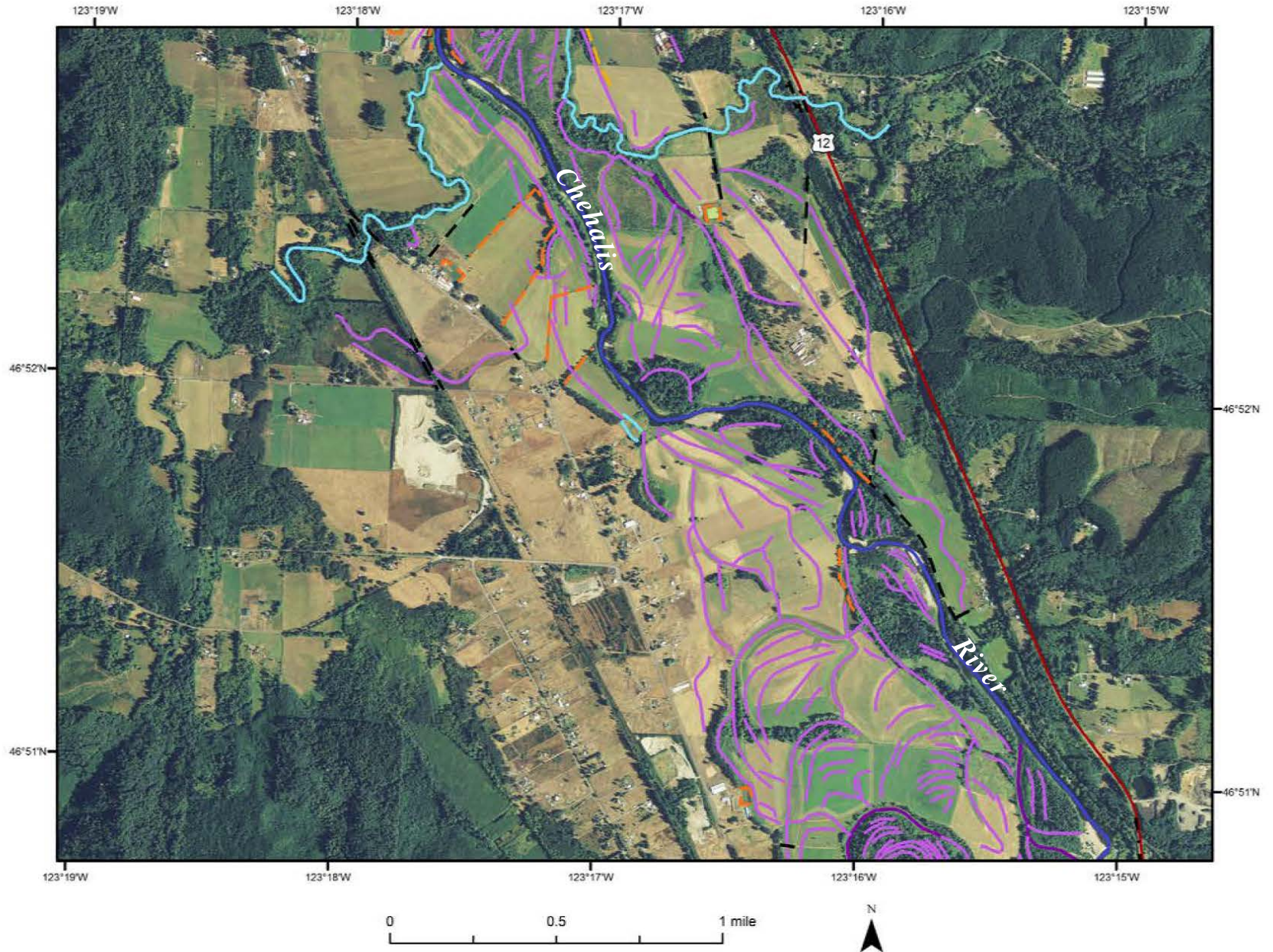
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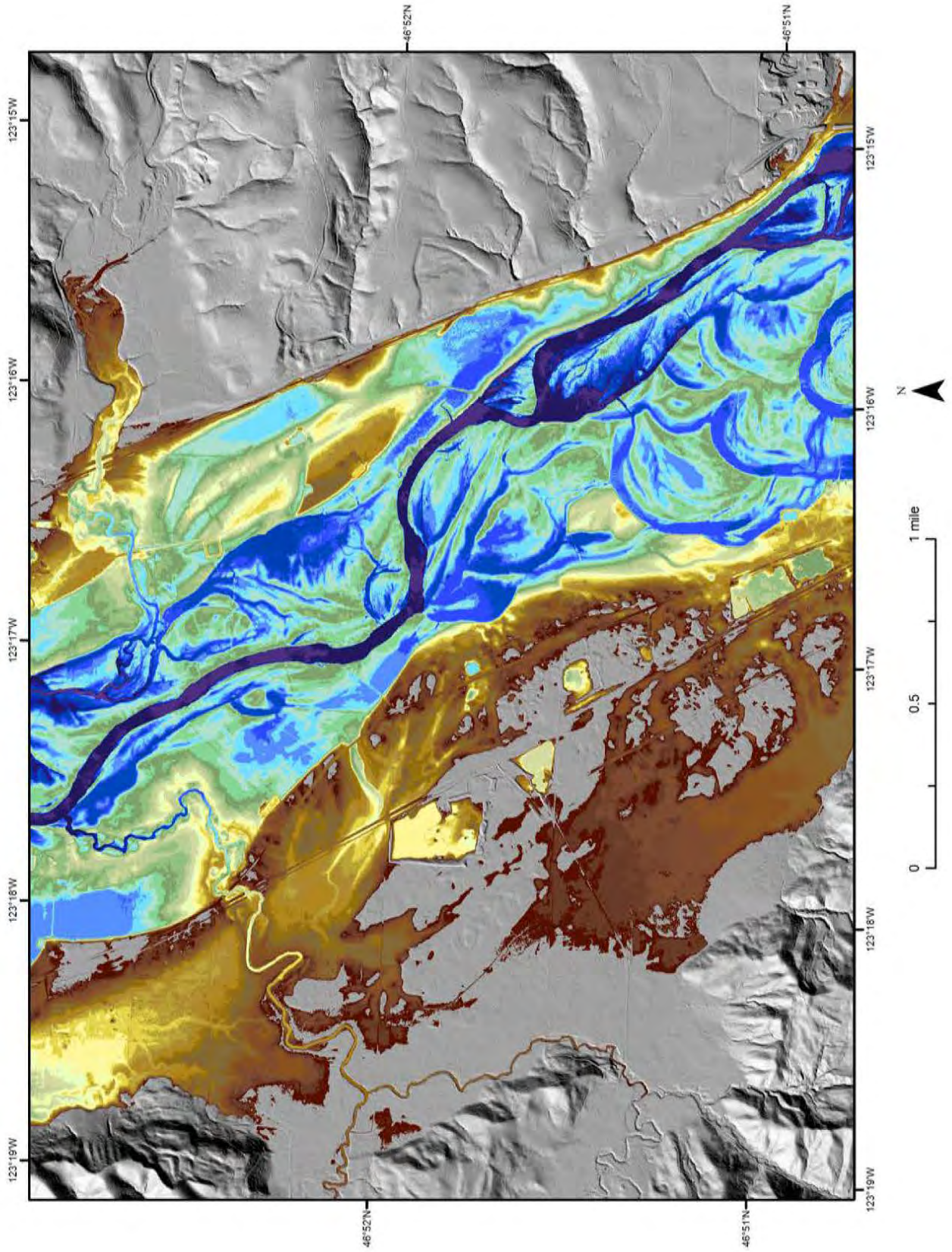
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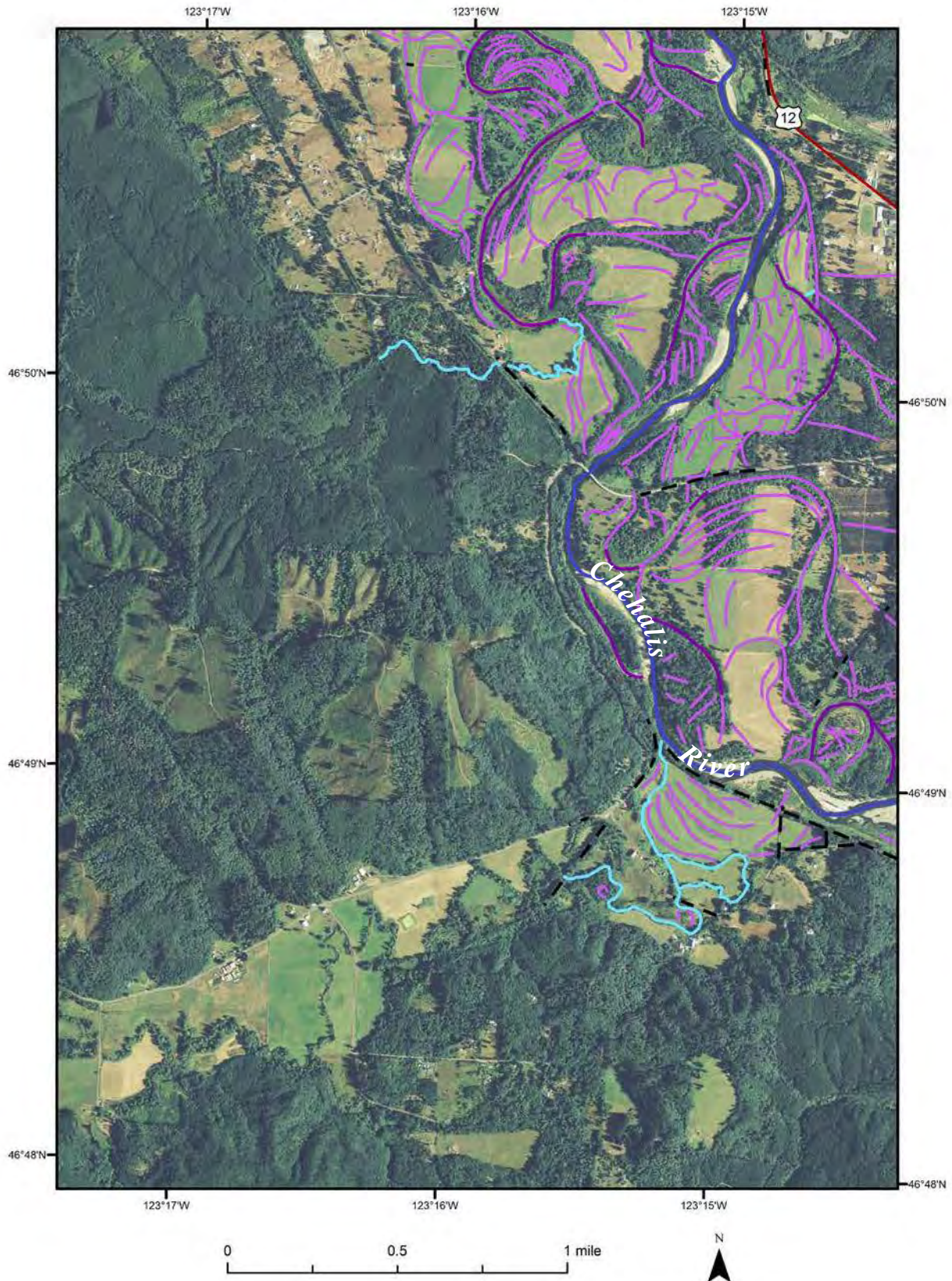
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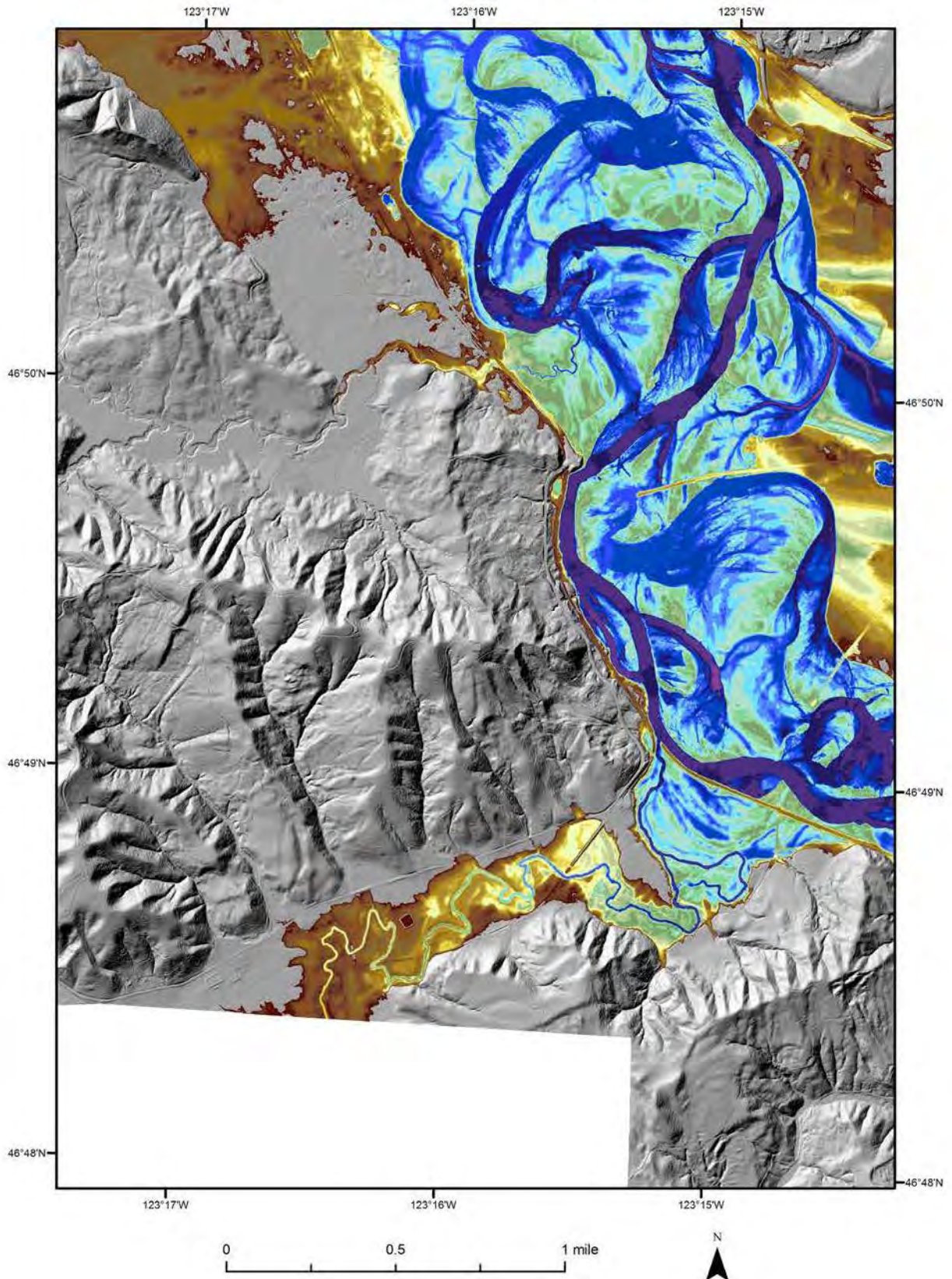
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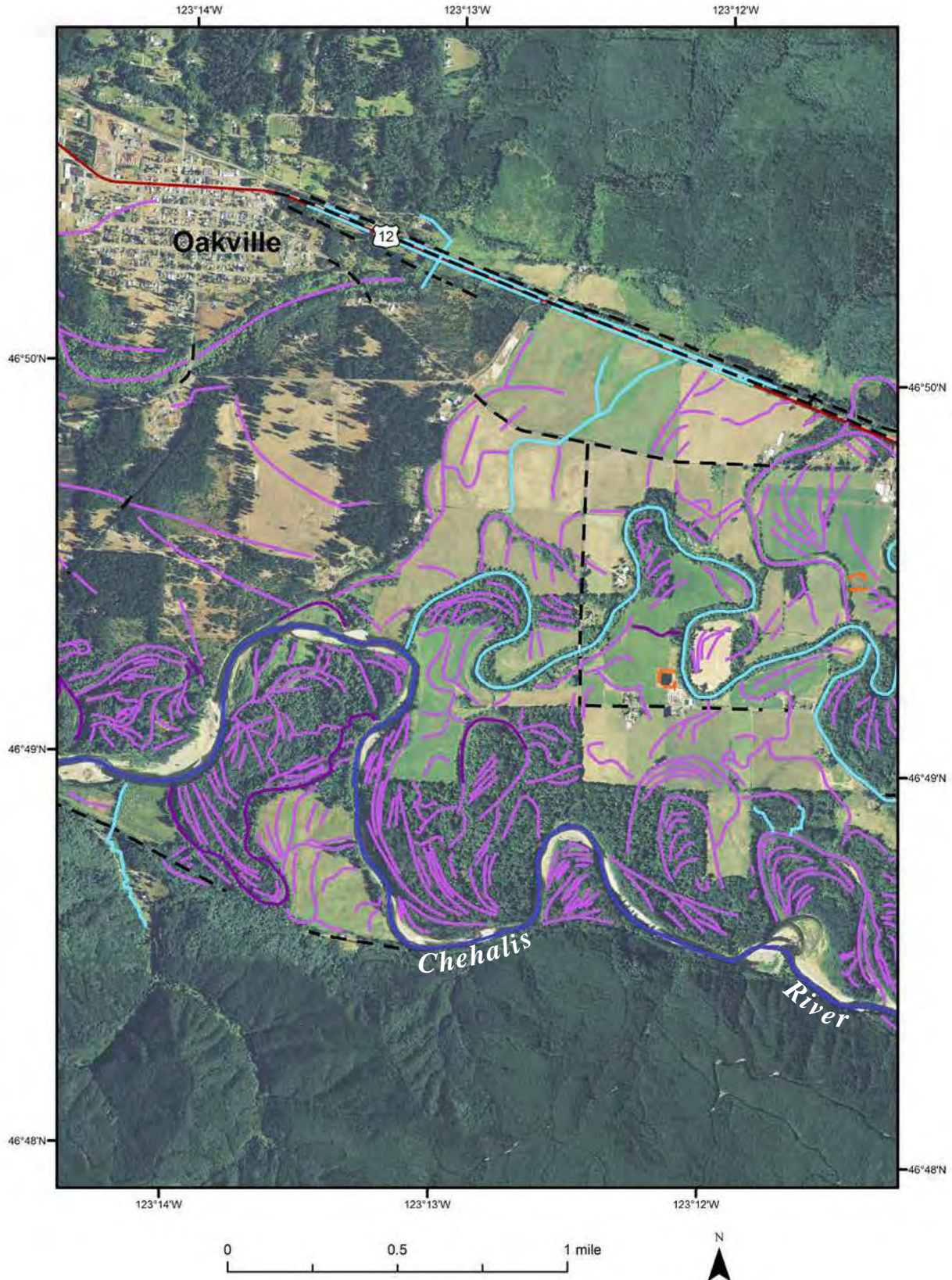
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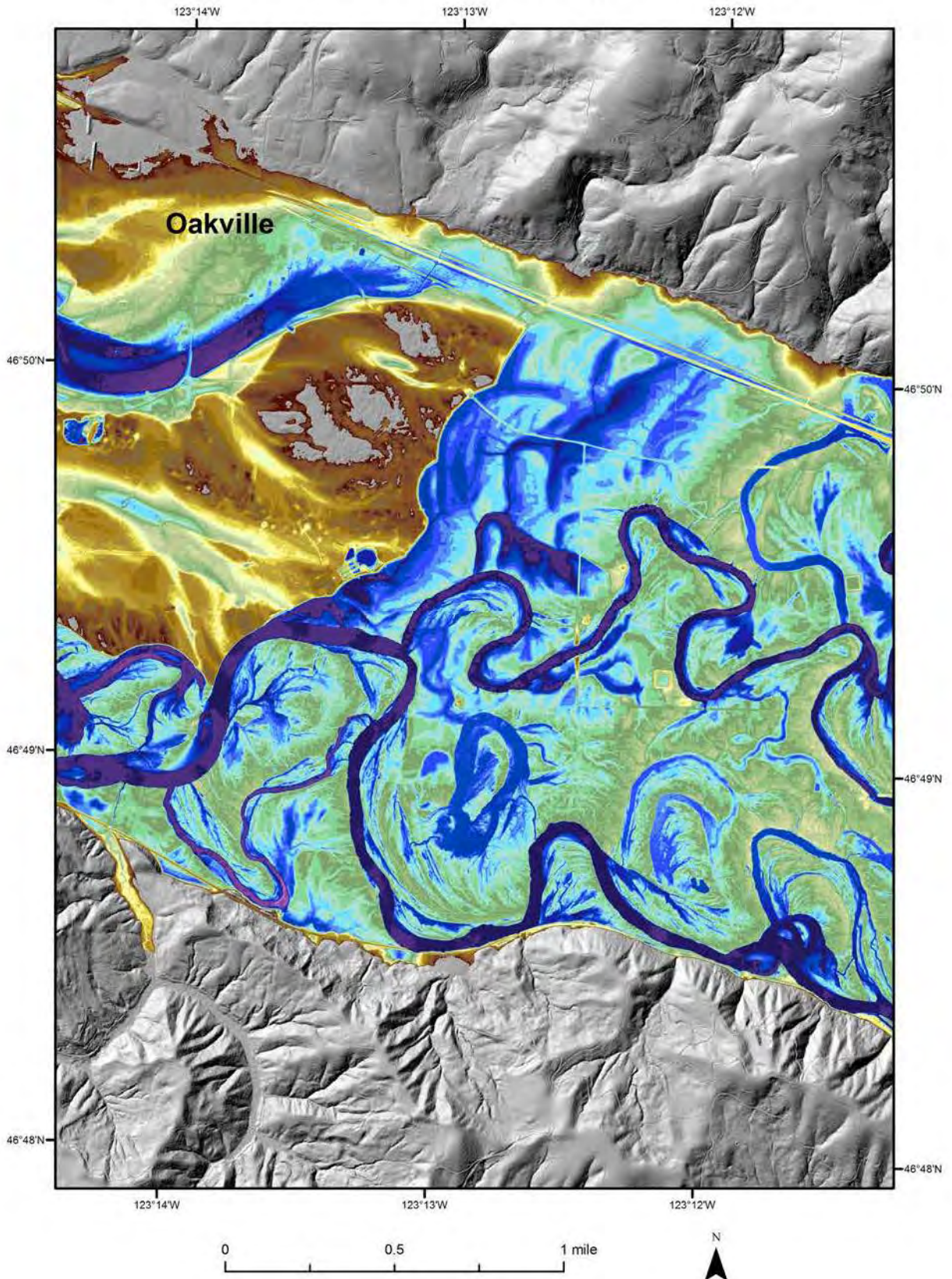
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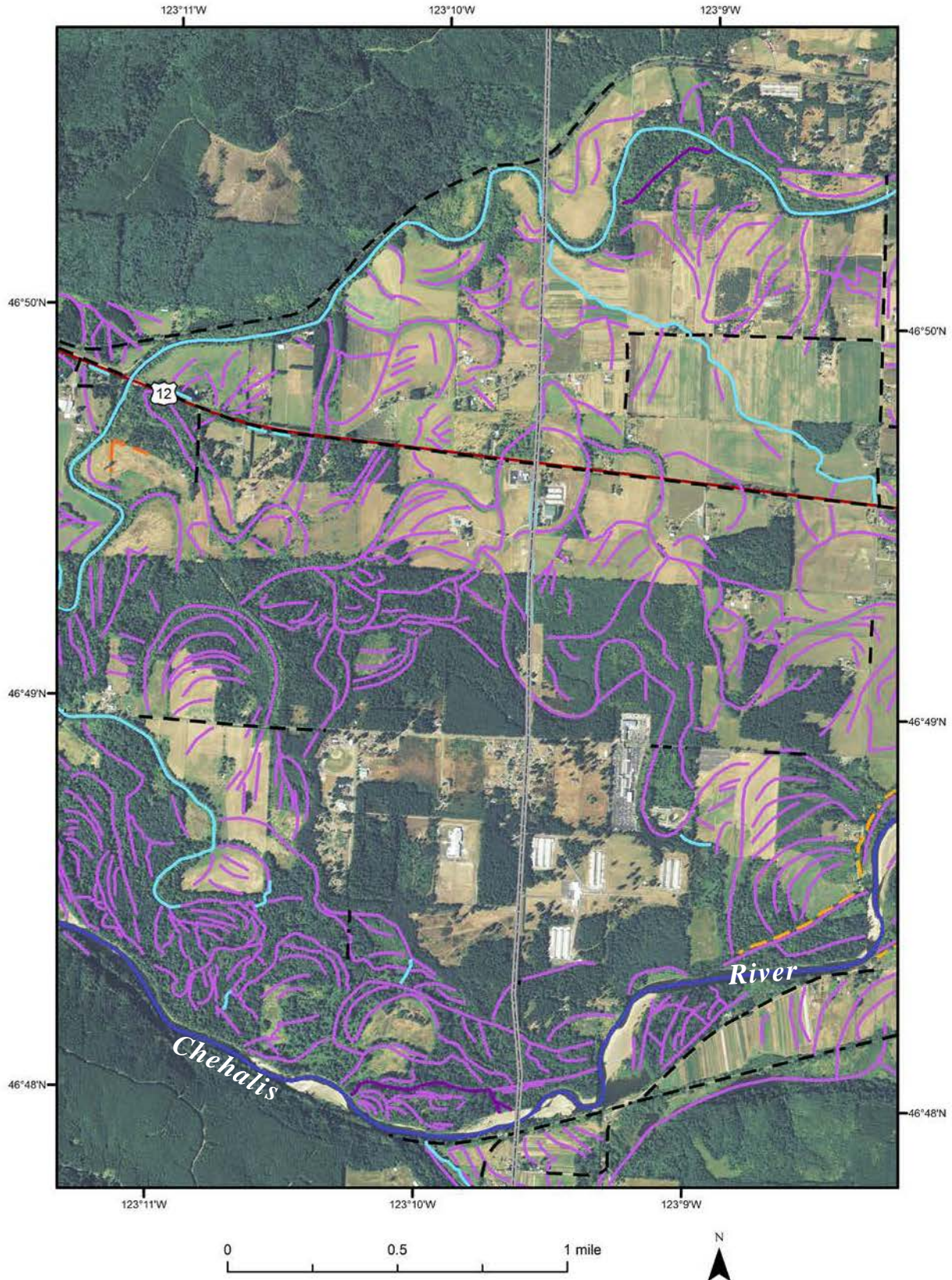
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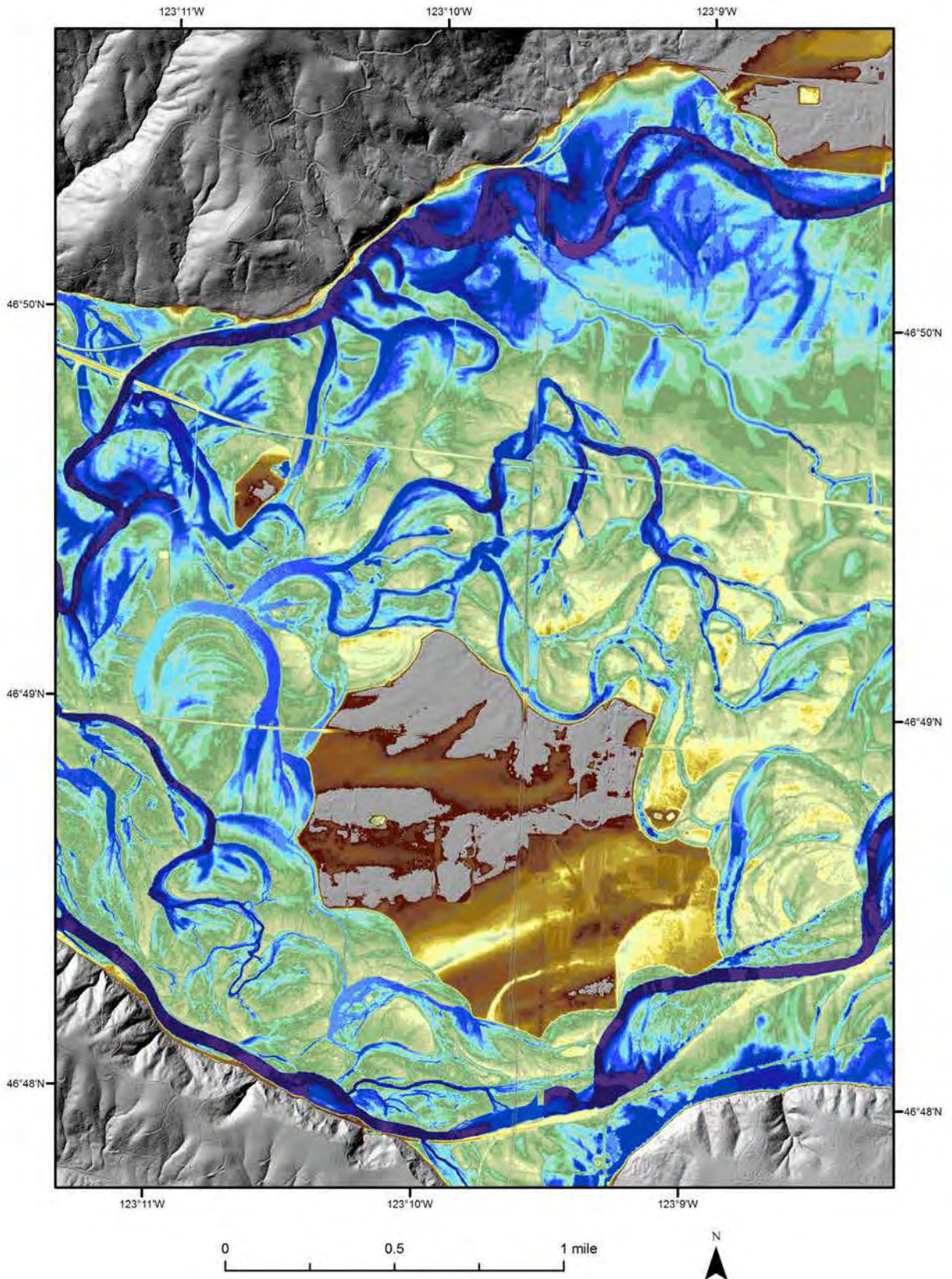
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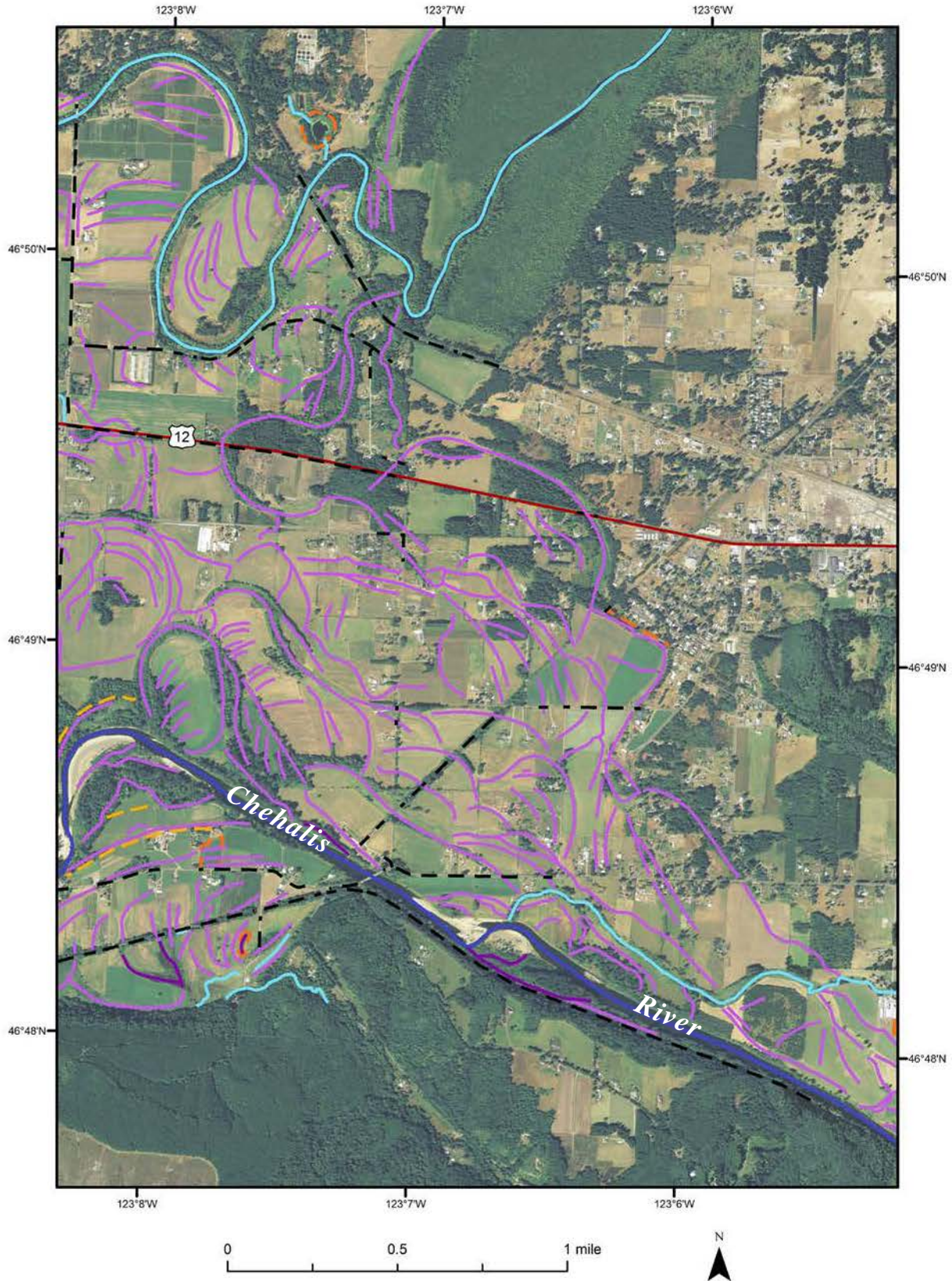
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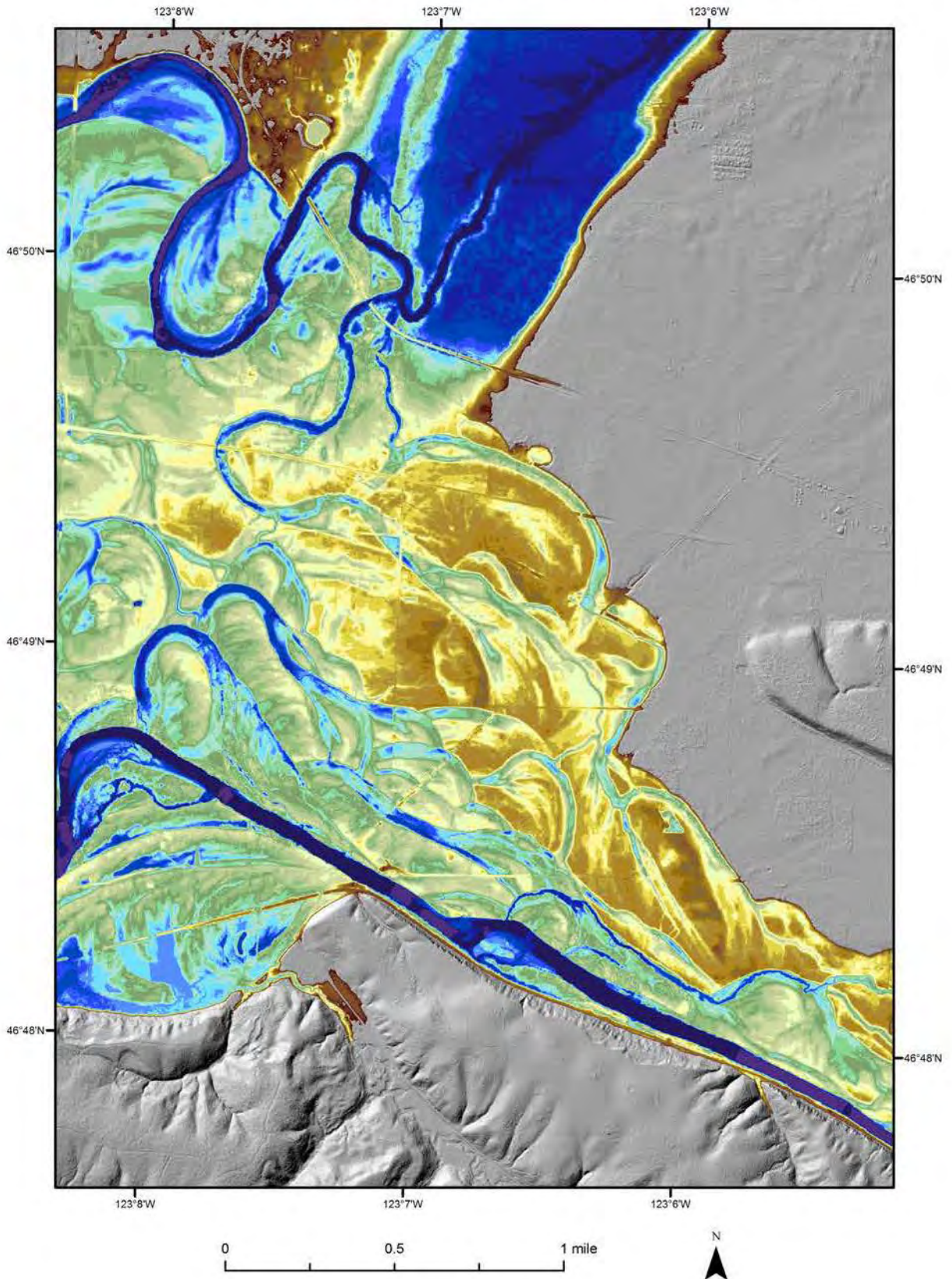
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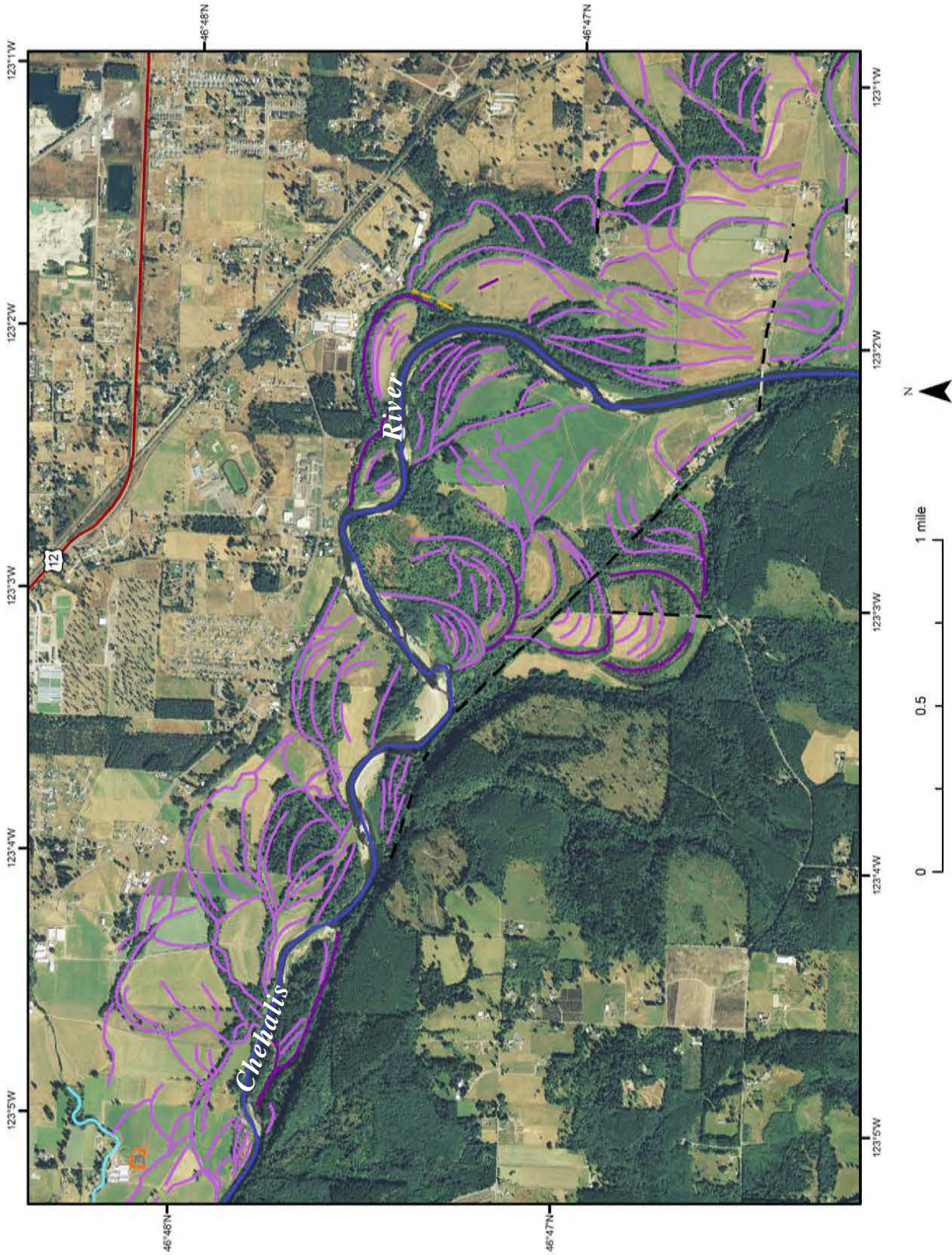
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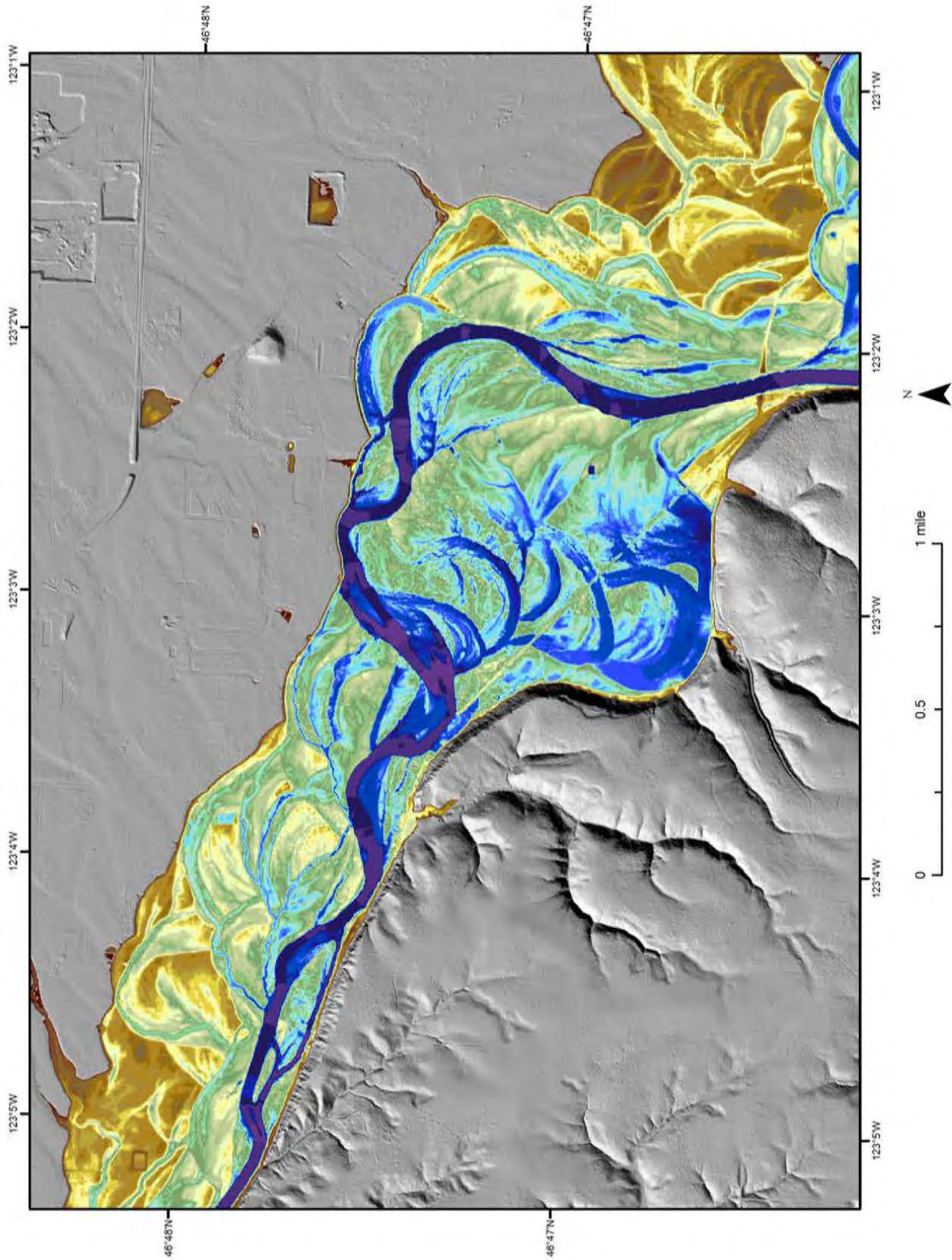
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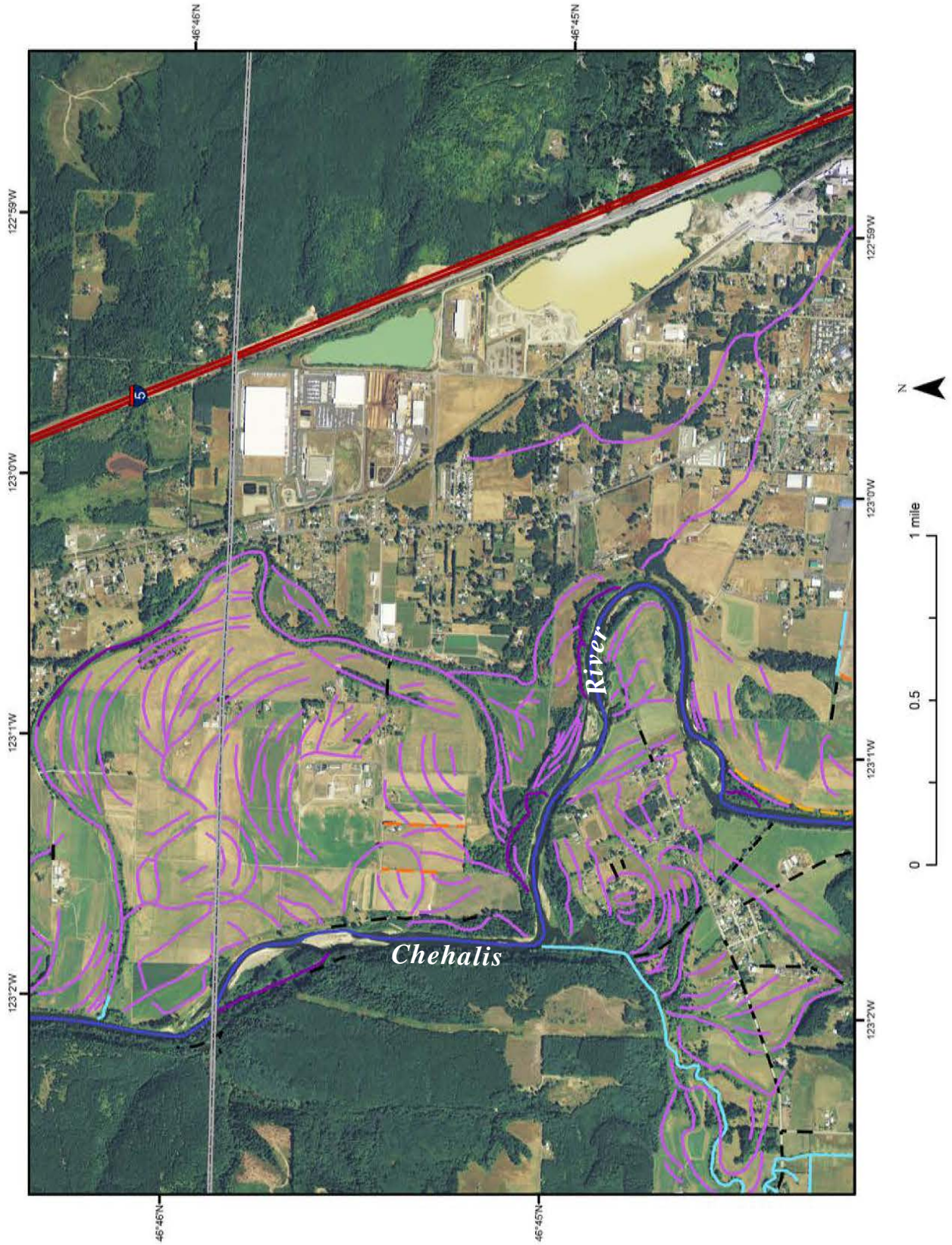
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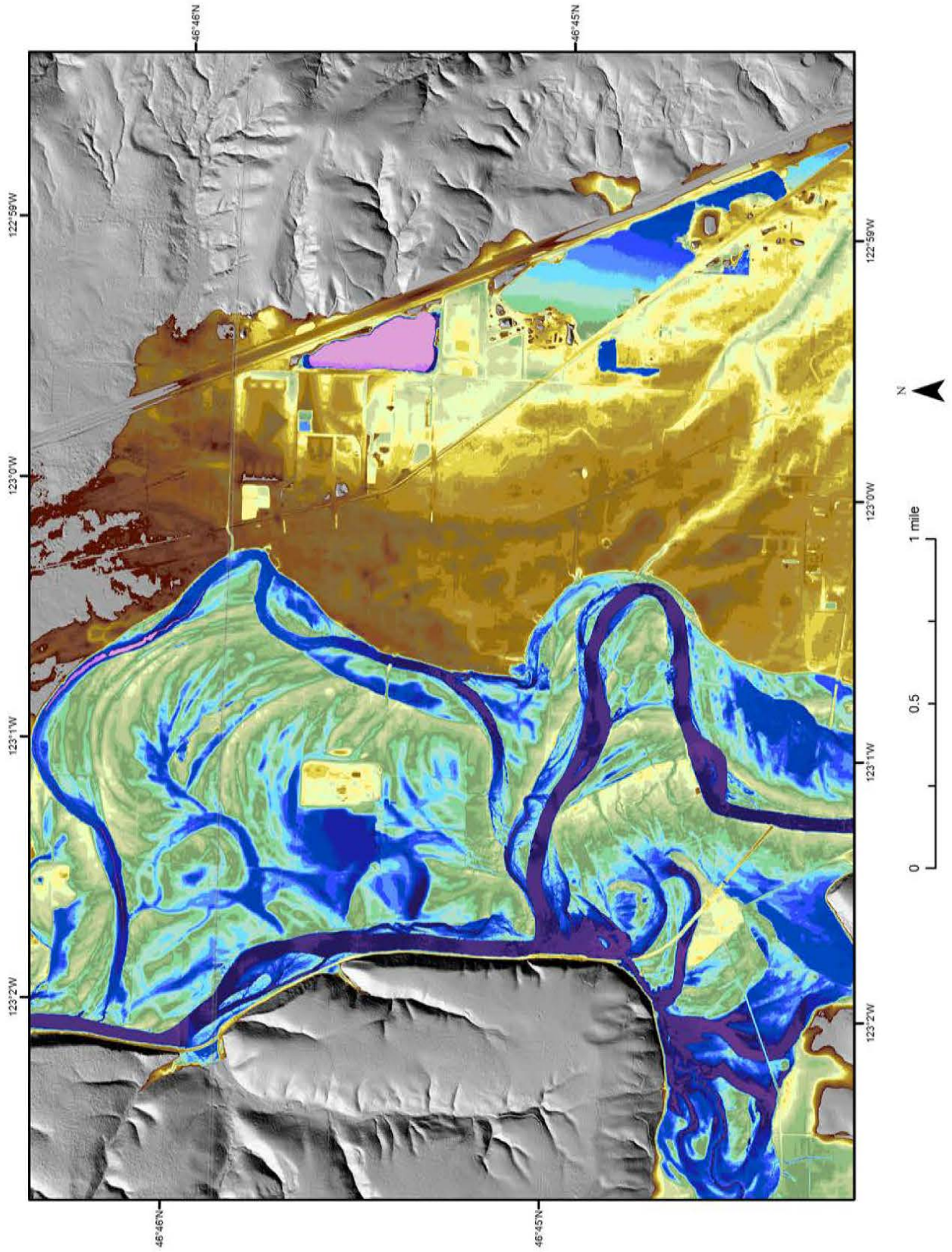
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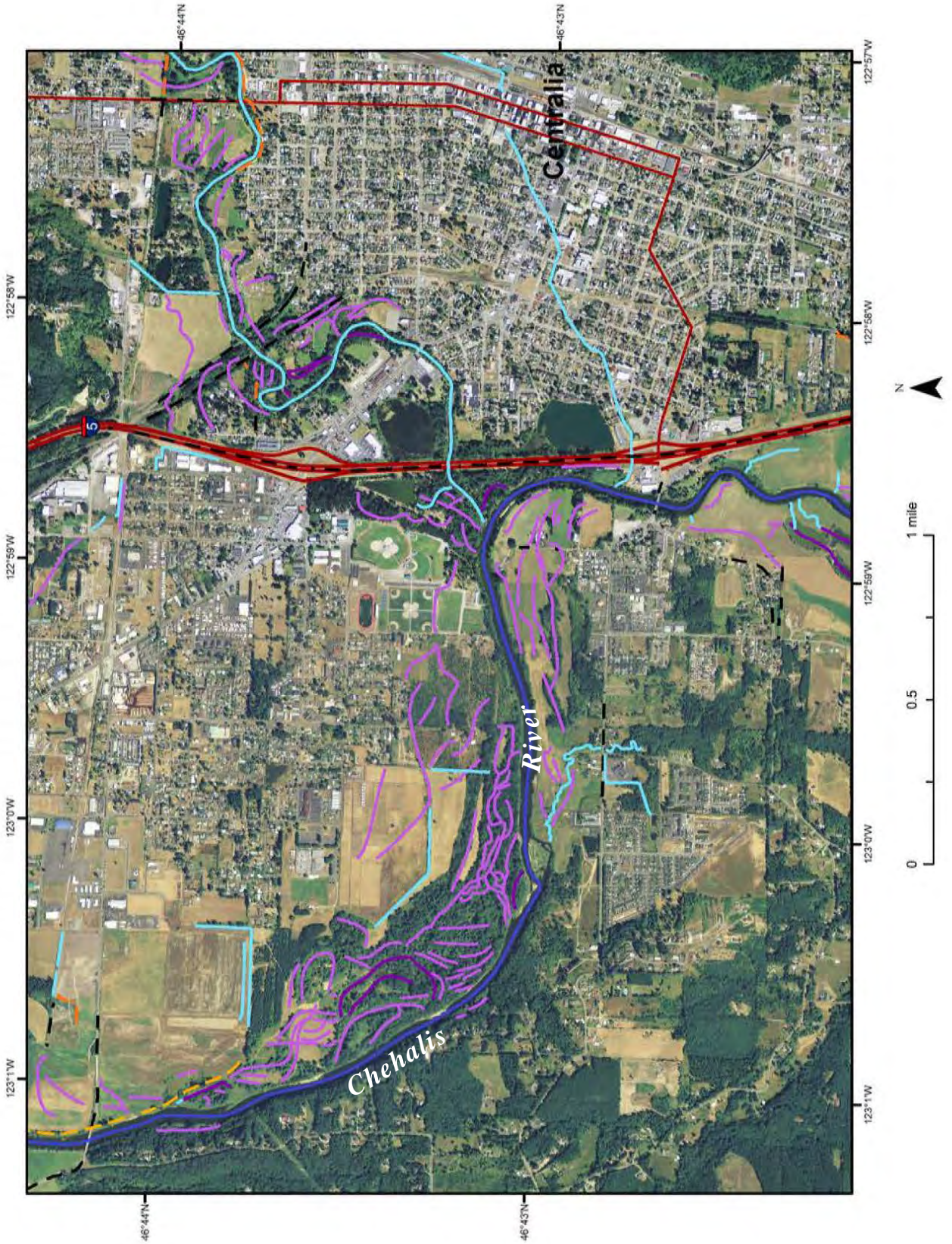
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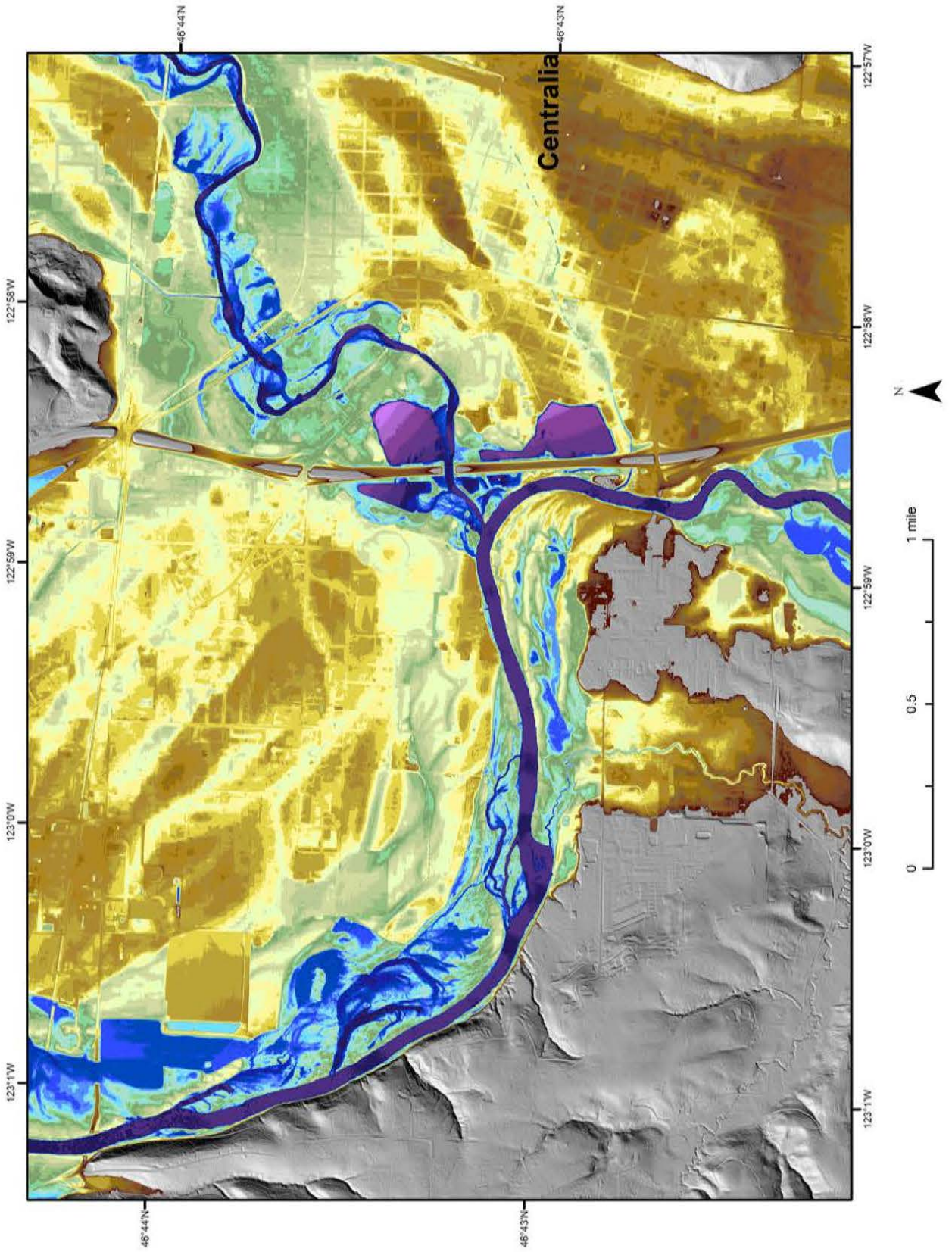
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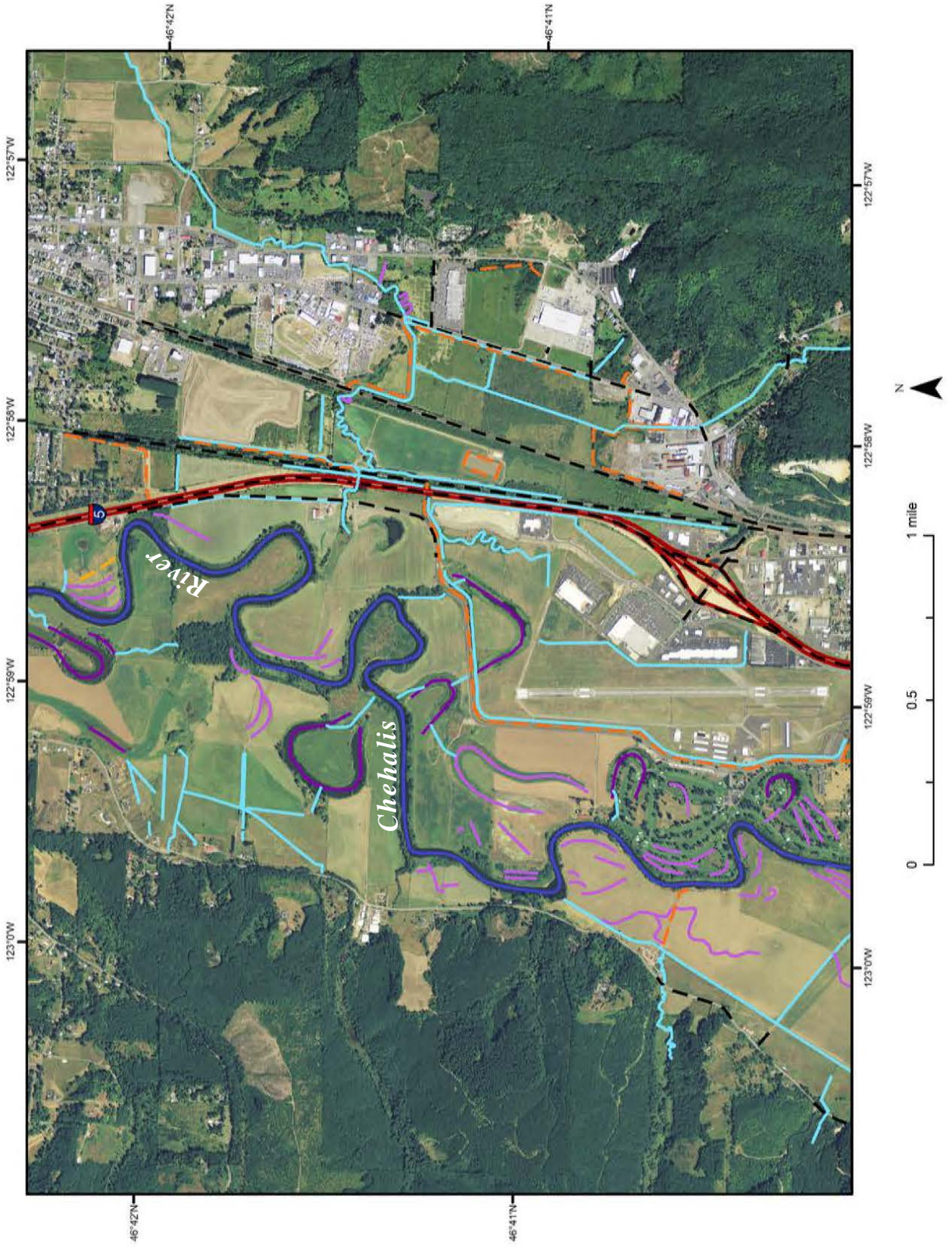
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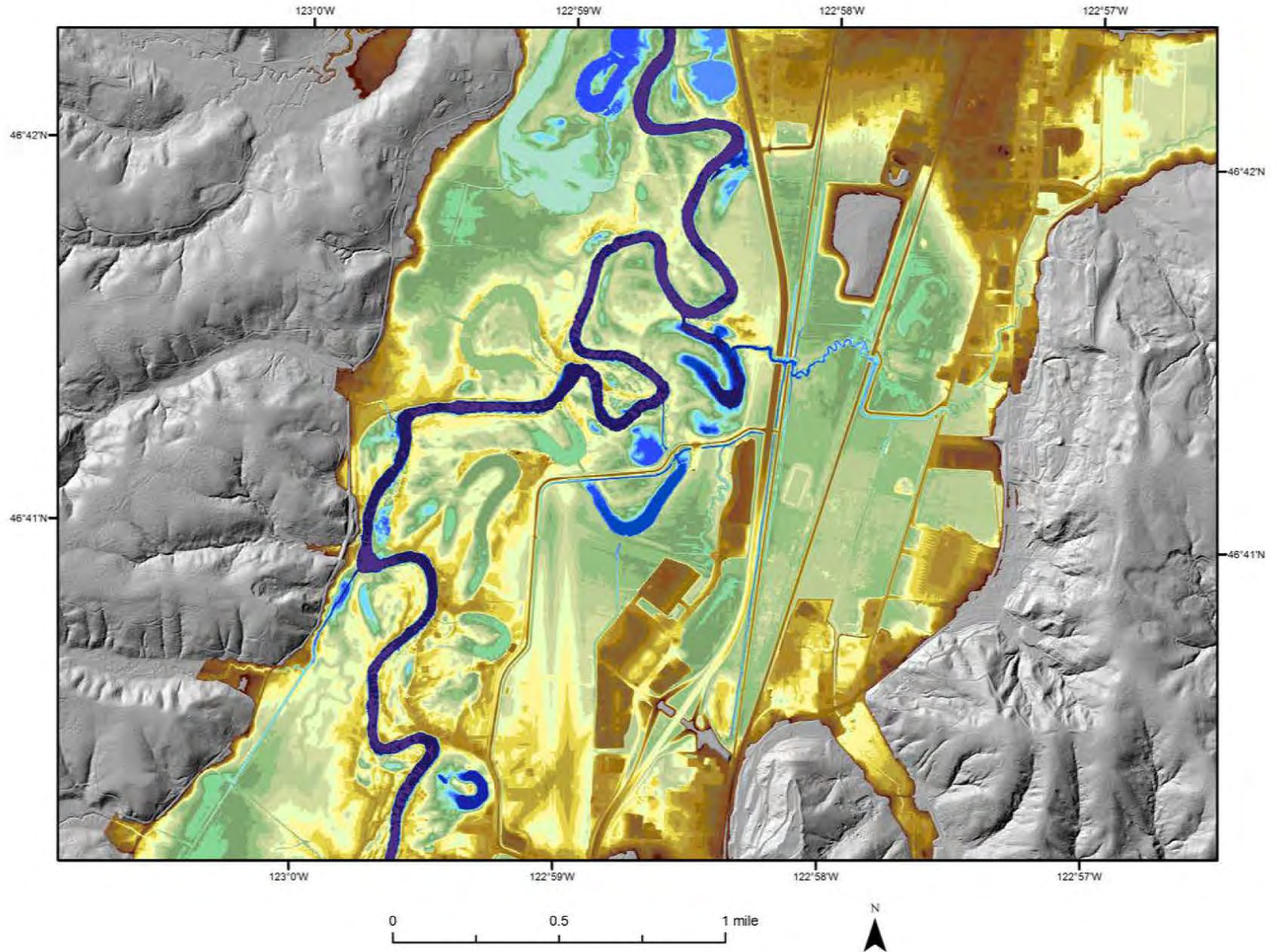


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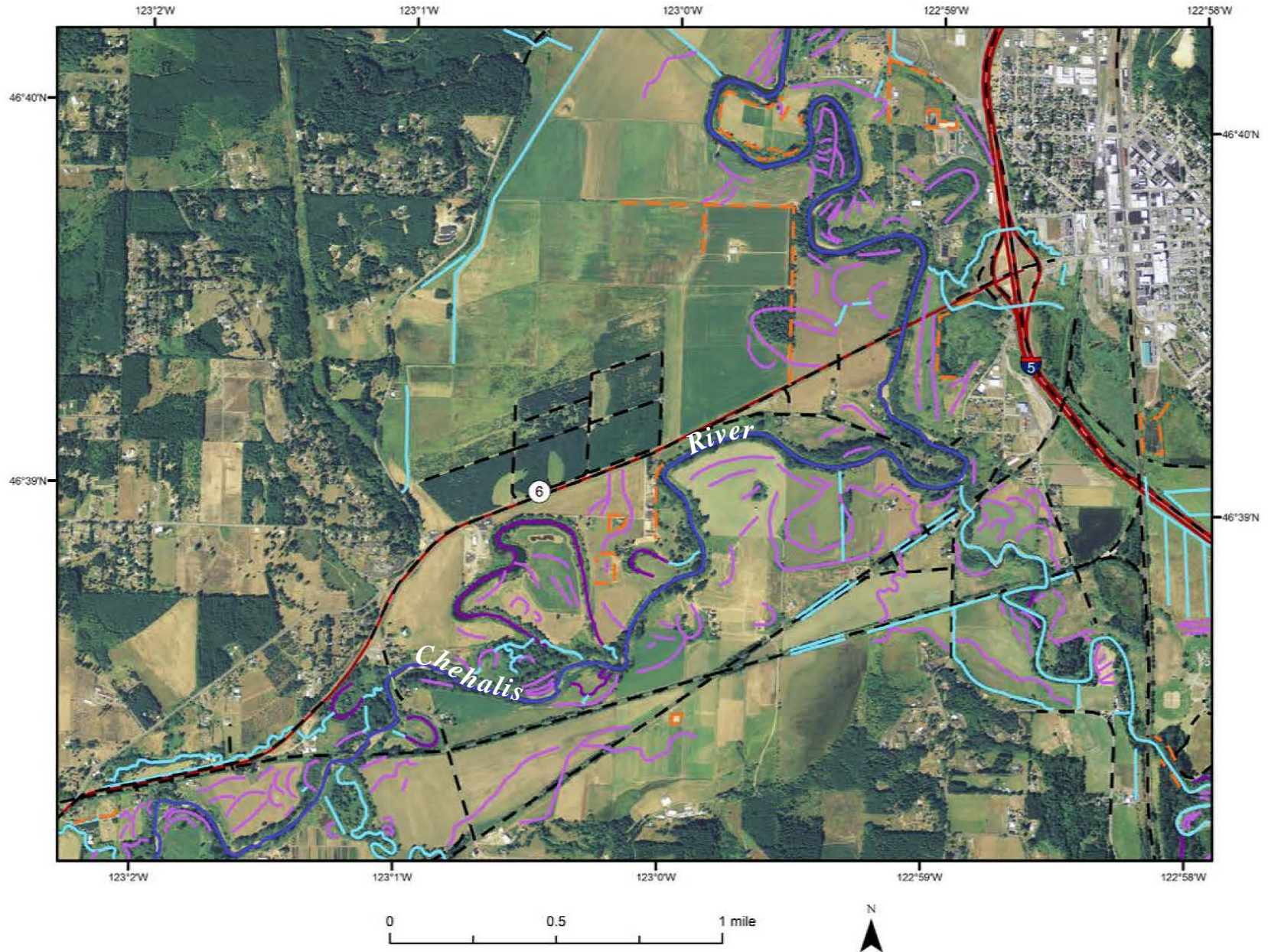


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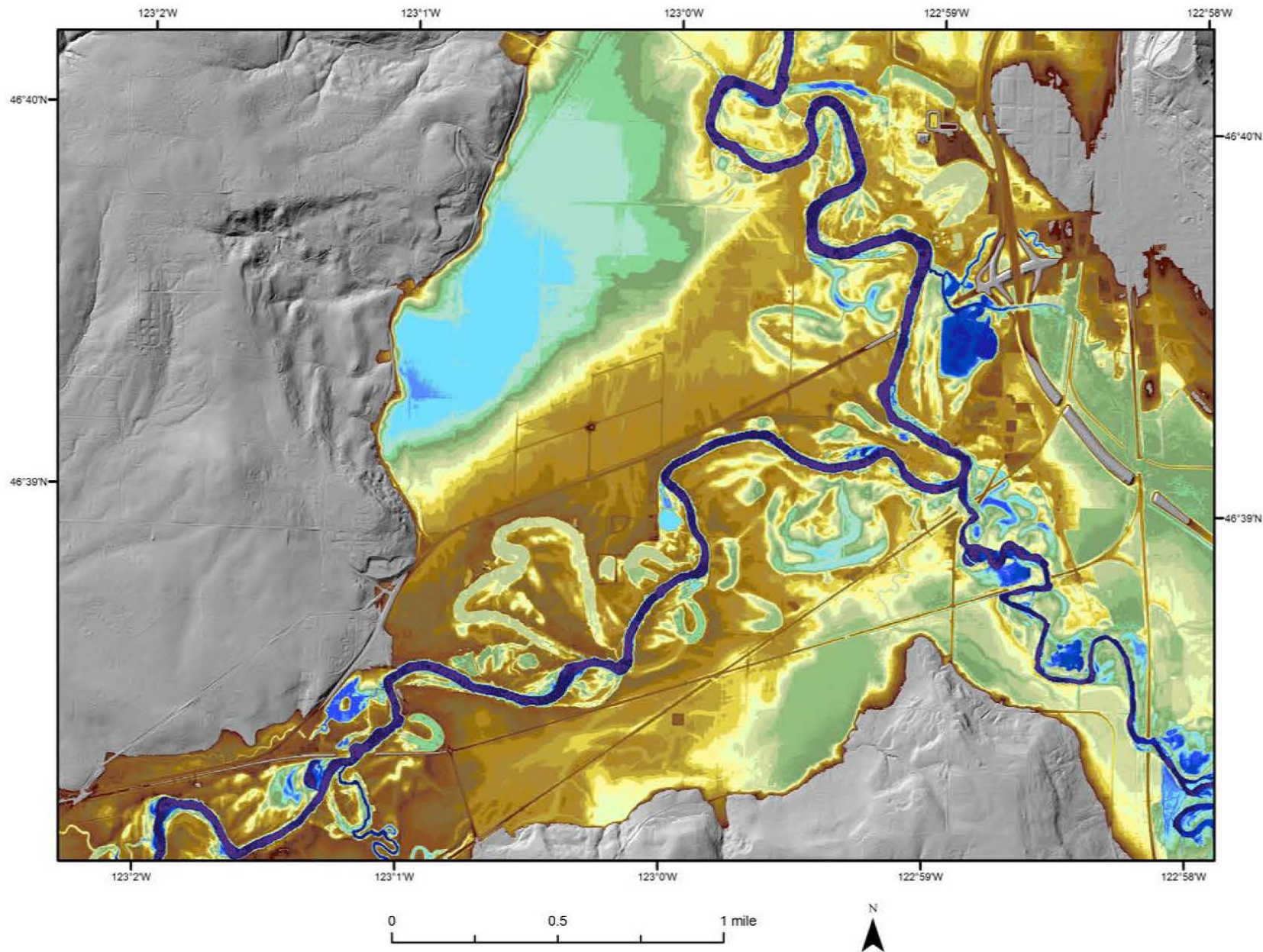
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Geomorphic Features - Map Sheet no. 22



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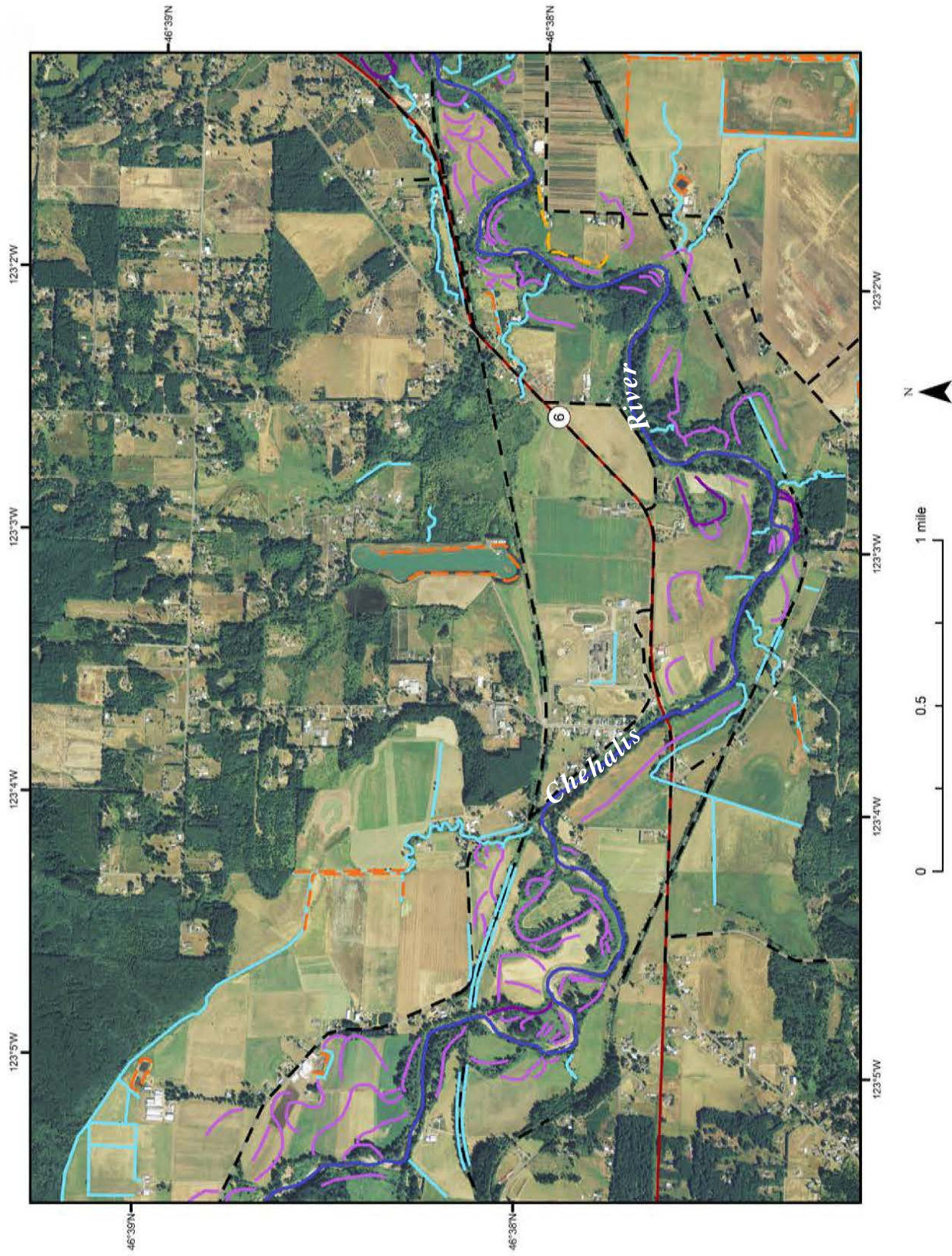
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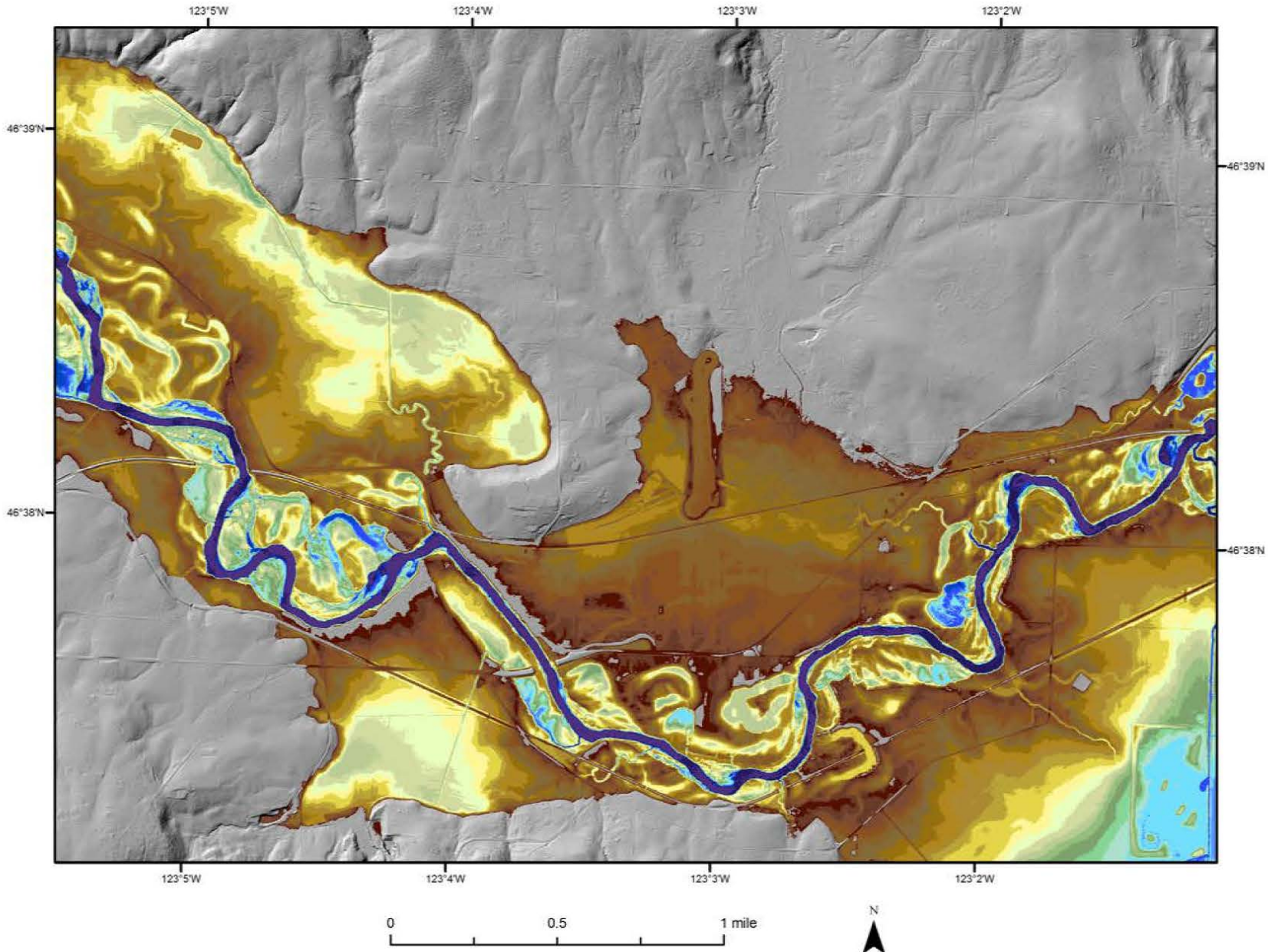
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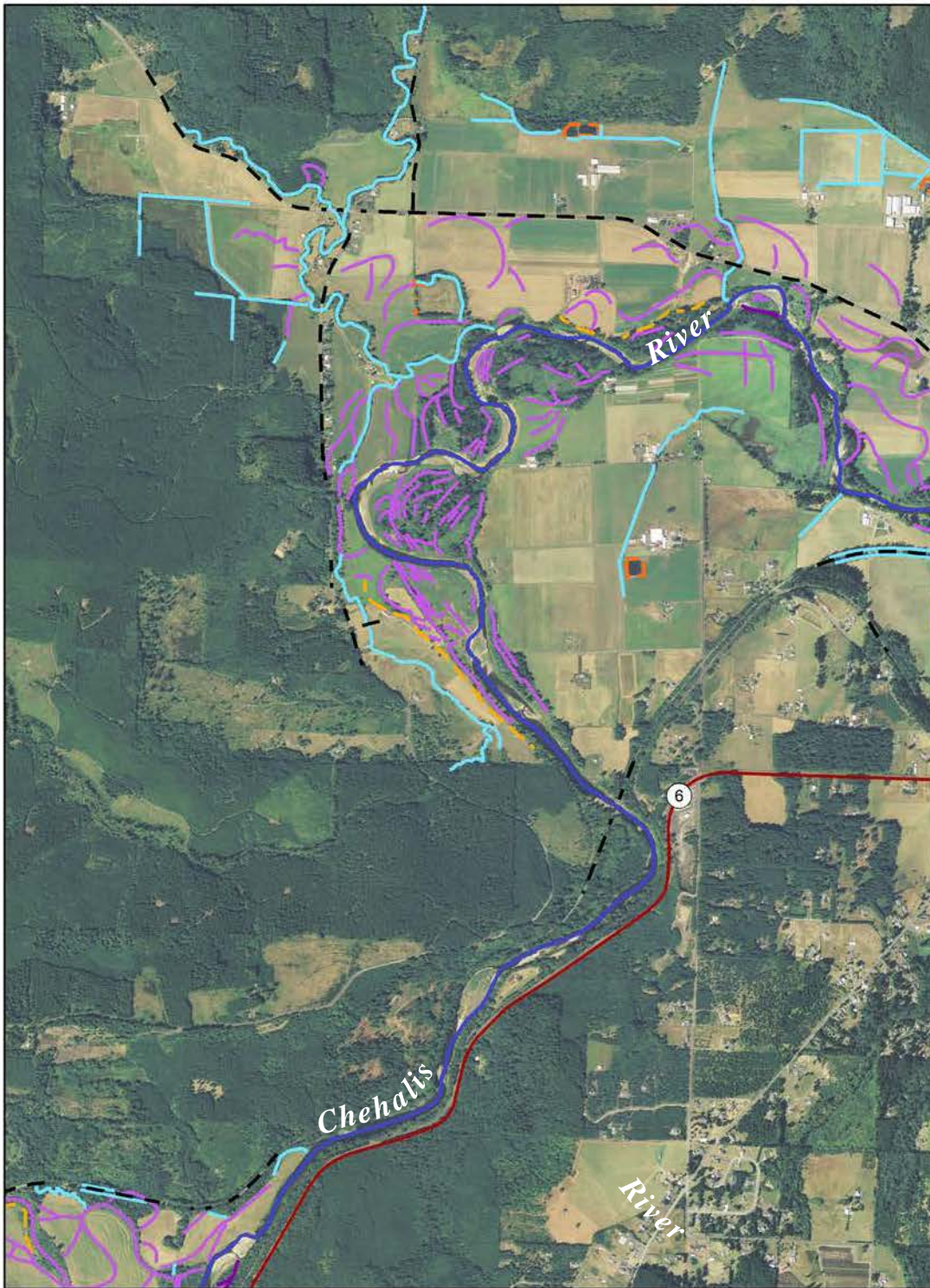
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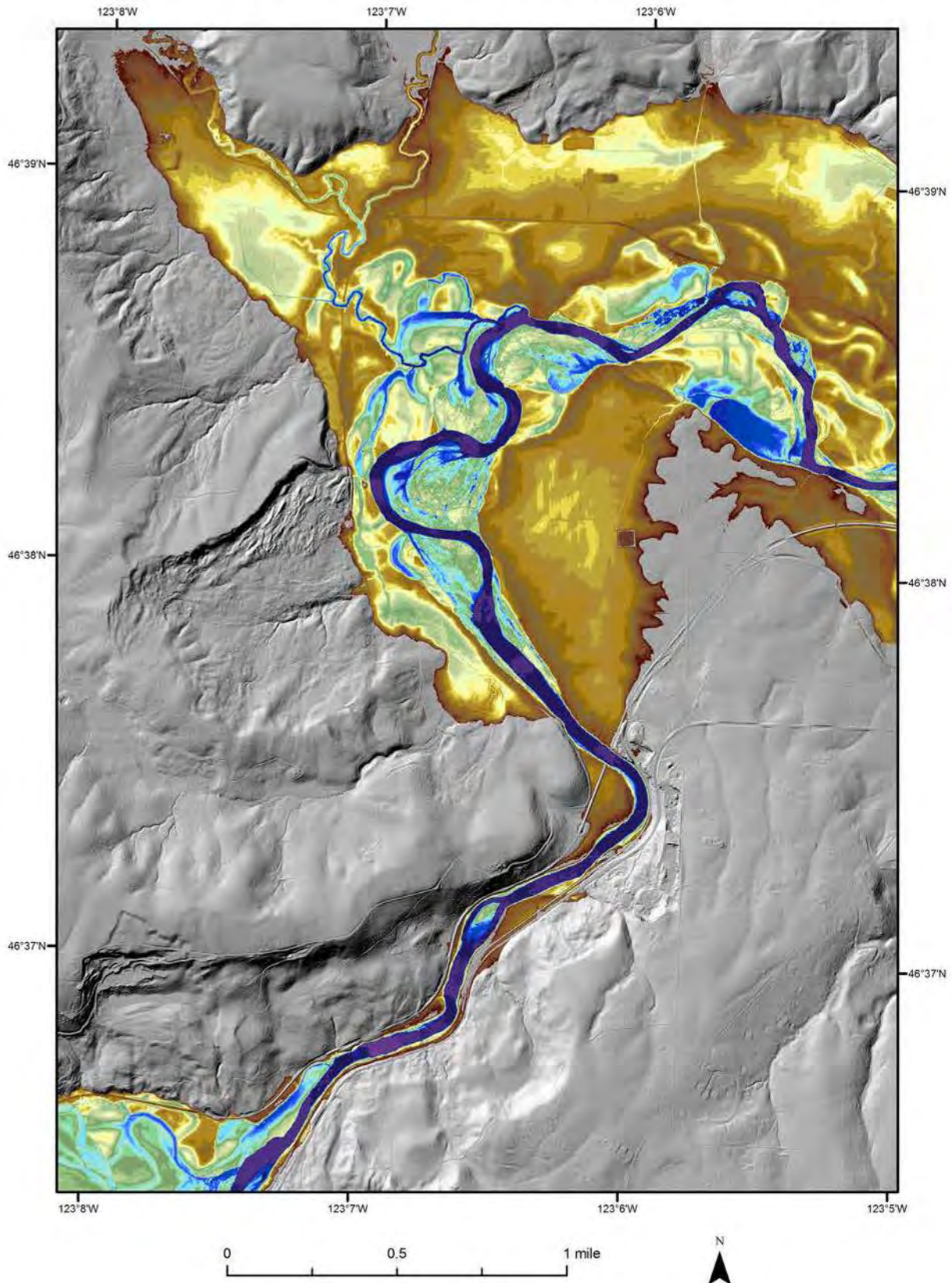


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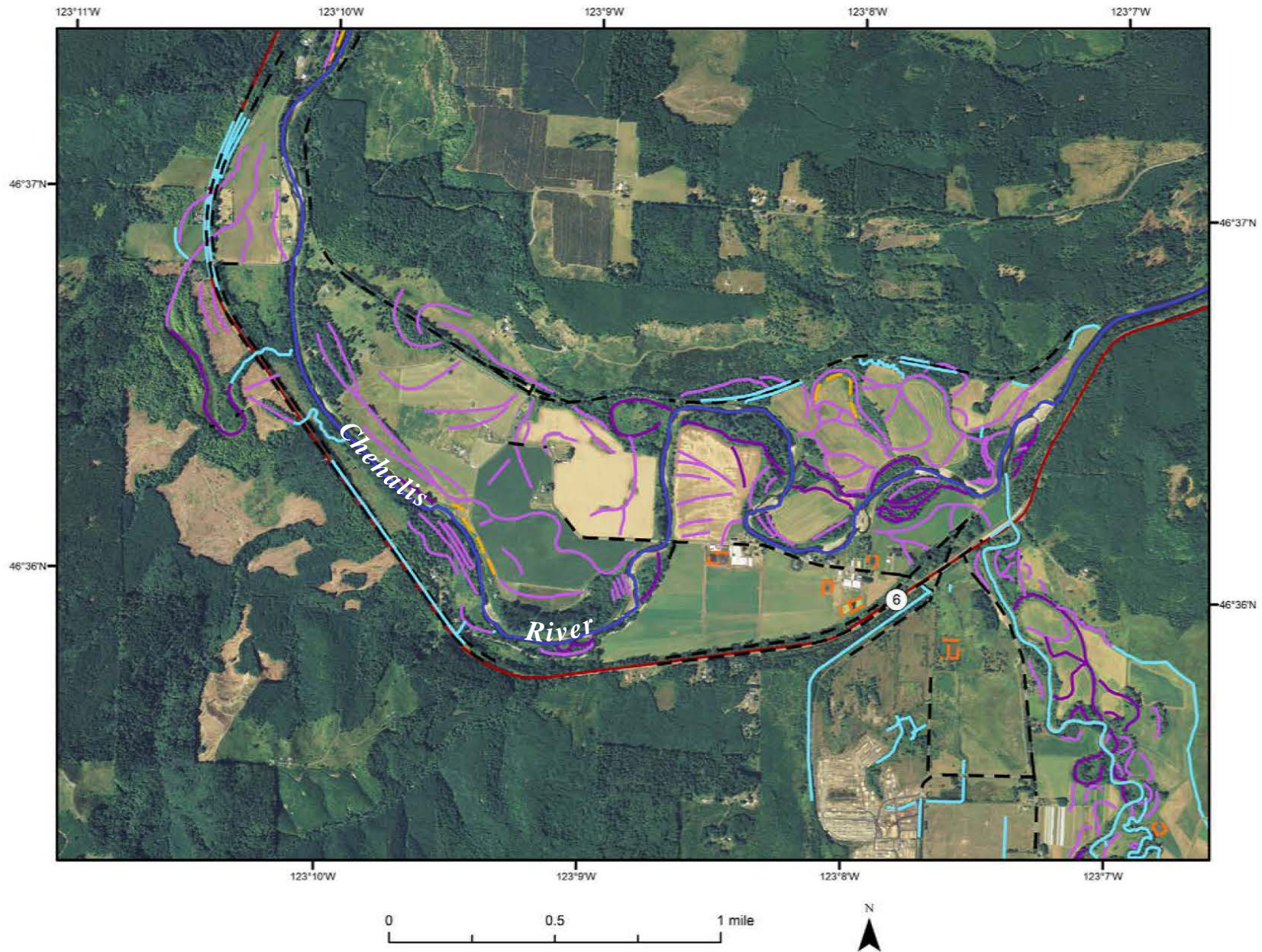


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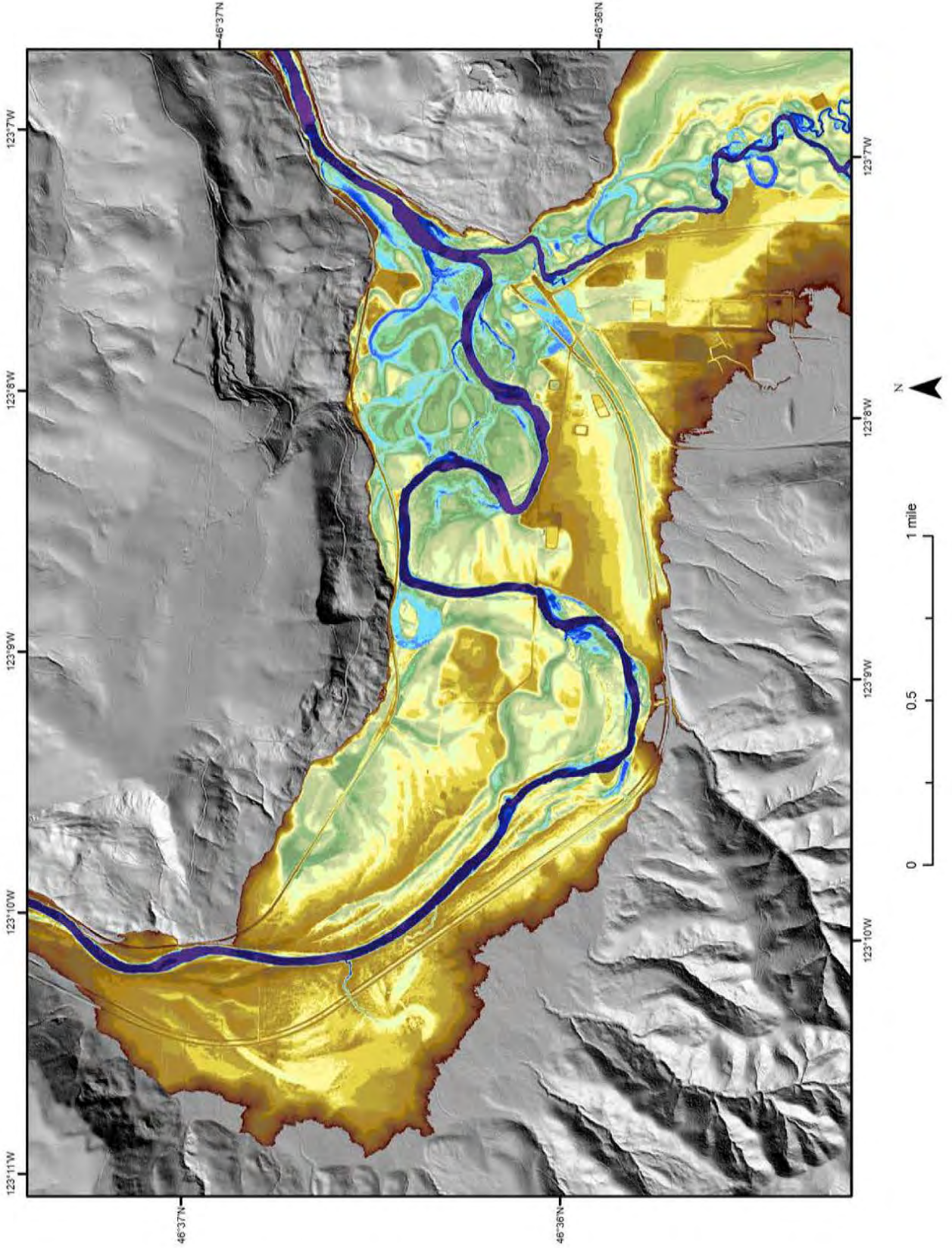
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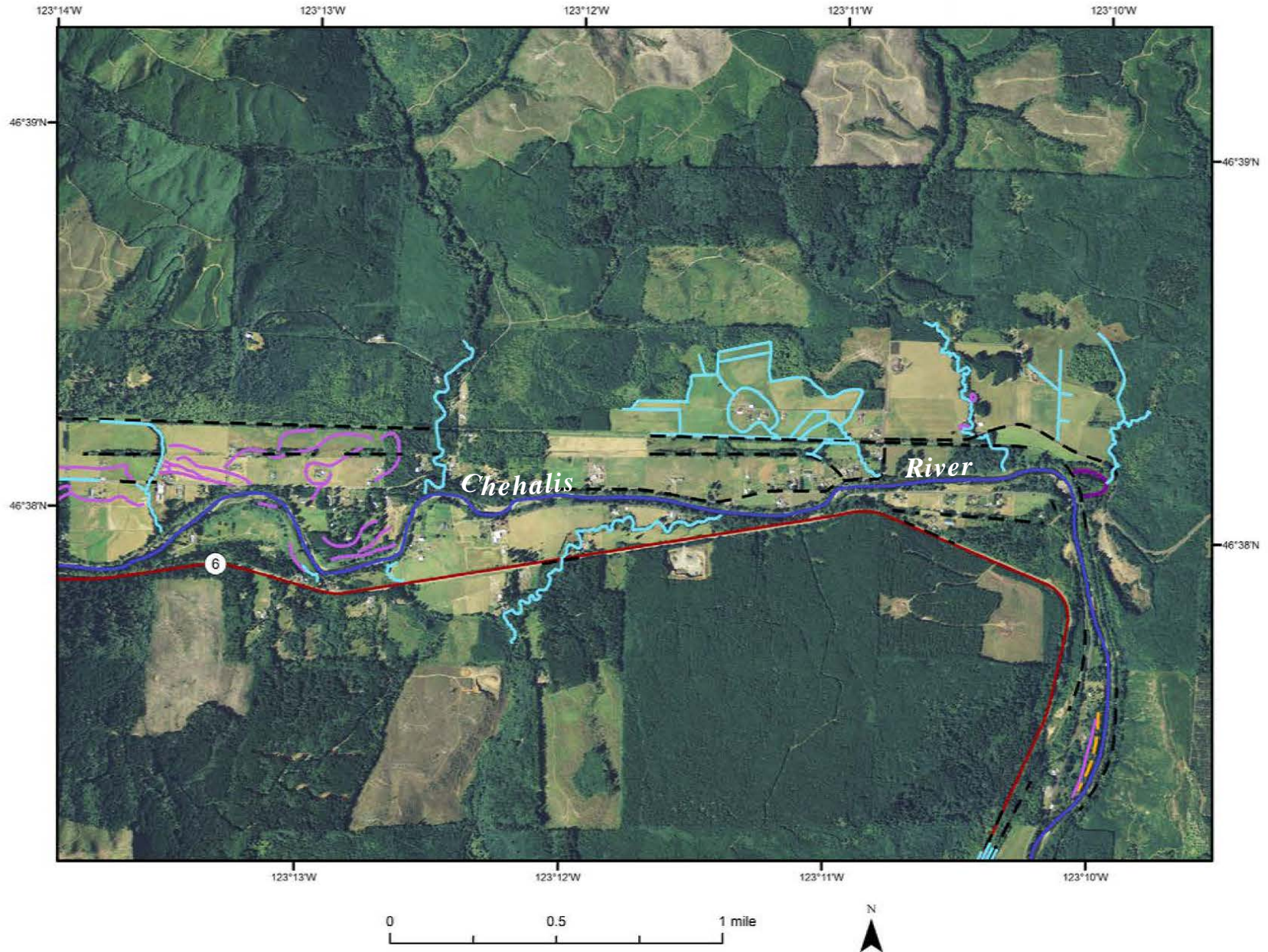
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Relative Elevation Model - Map Sheet no. 25

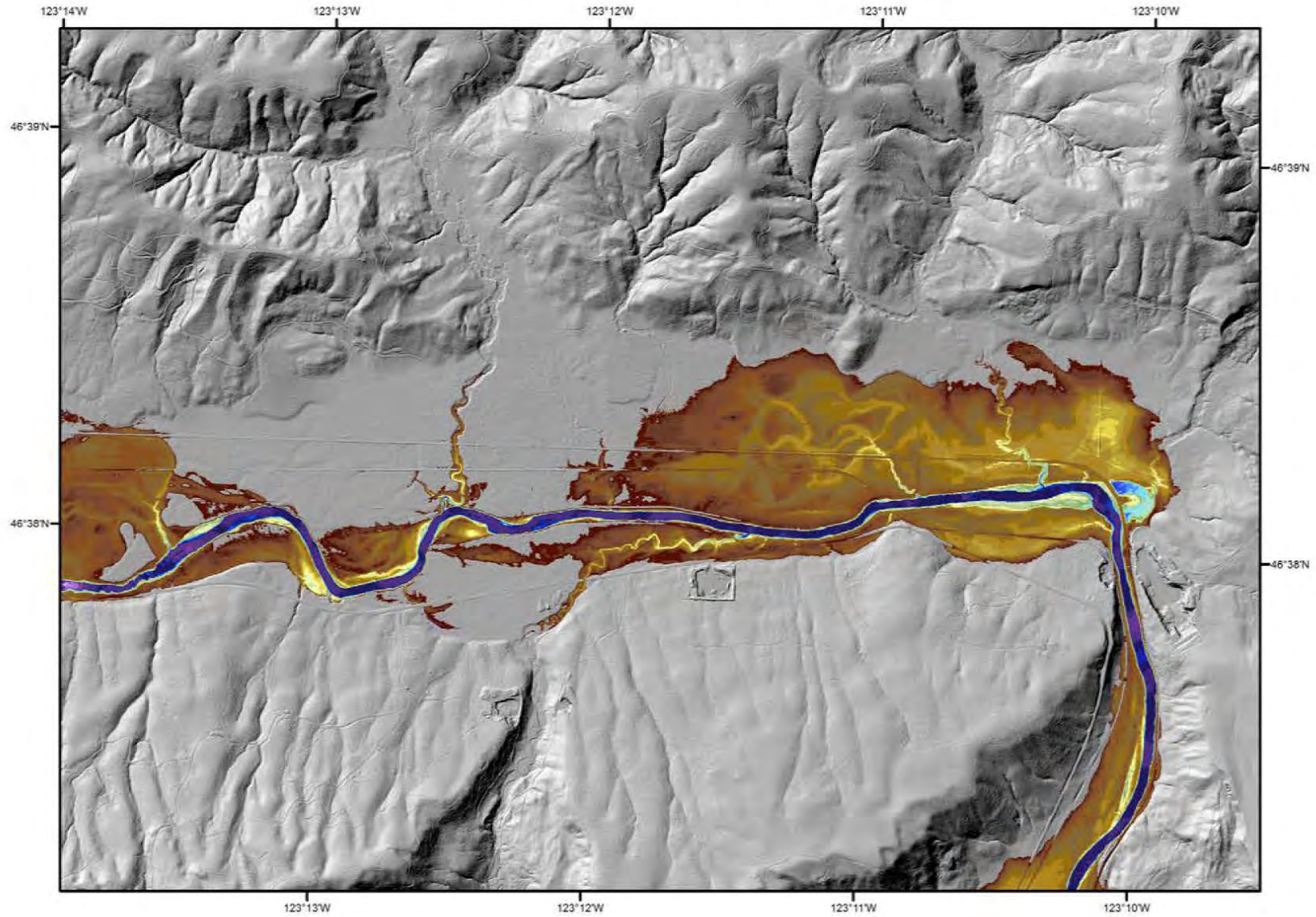


Geomorphic Features - Map Sheet no. 26



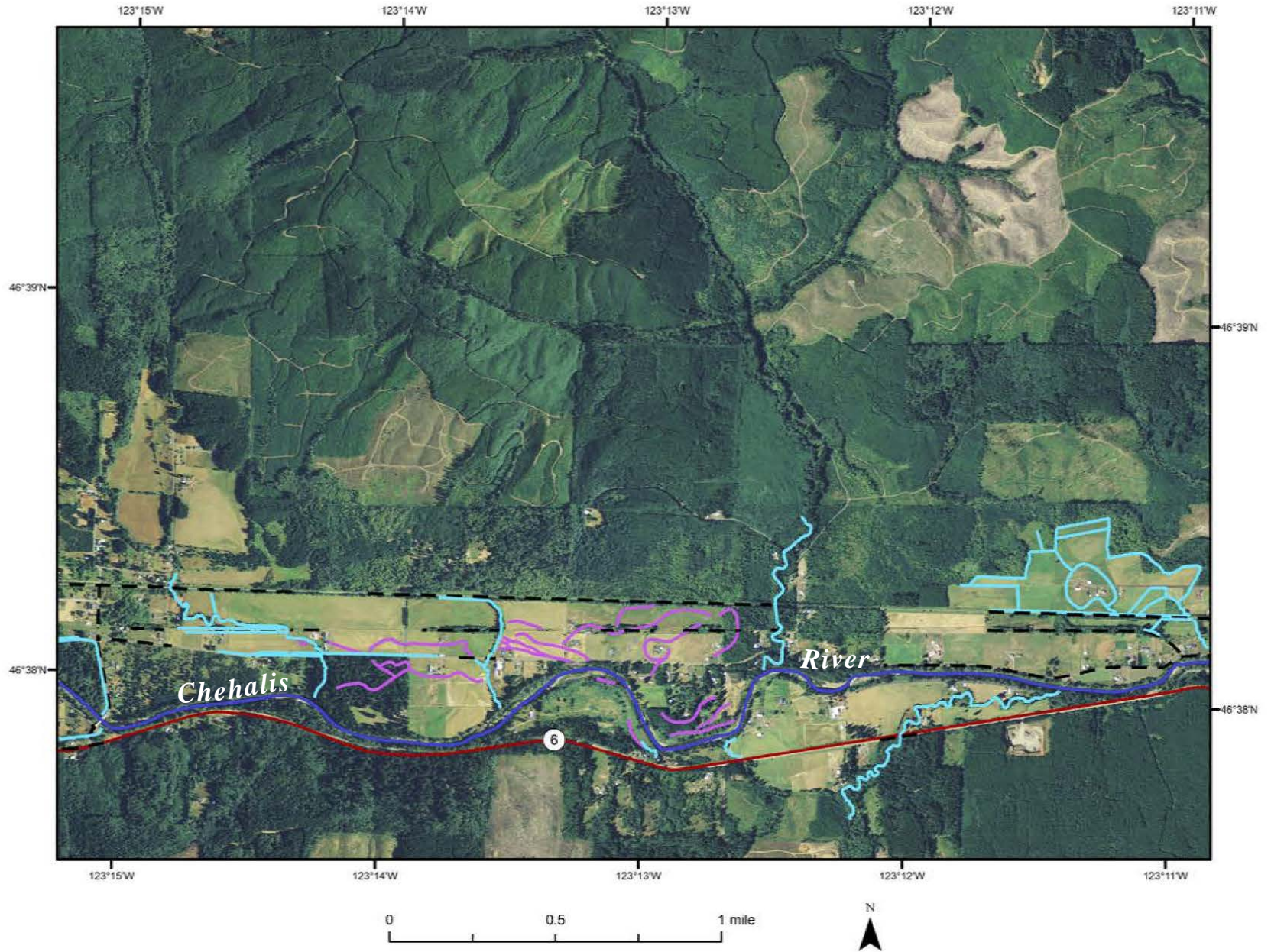
[Click here to return to map index](#)

Relative Elevation Model - Map Sheet no. 26



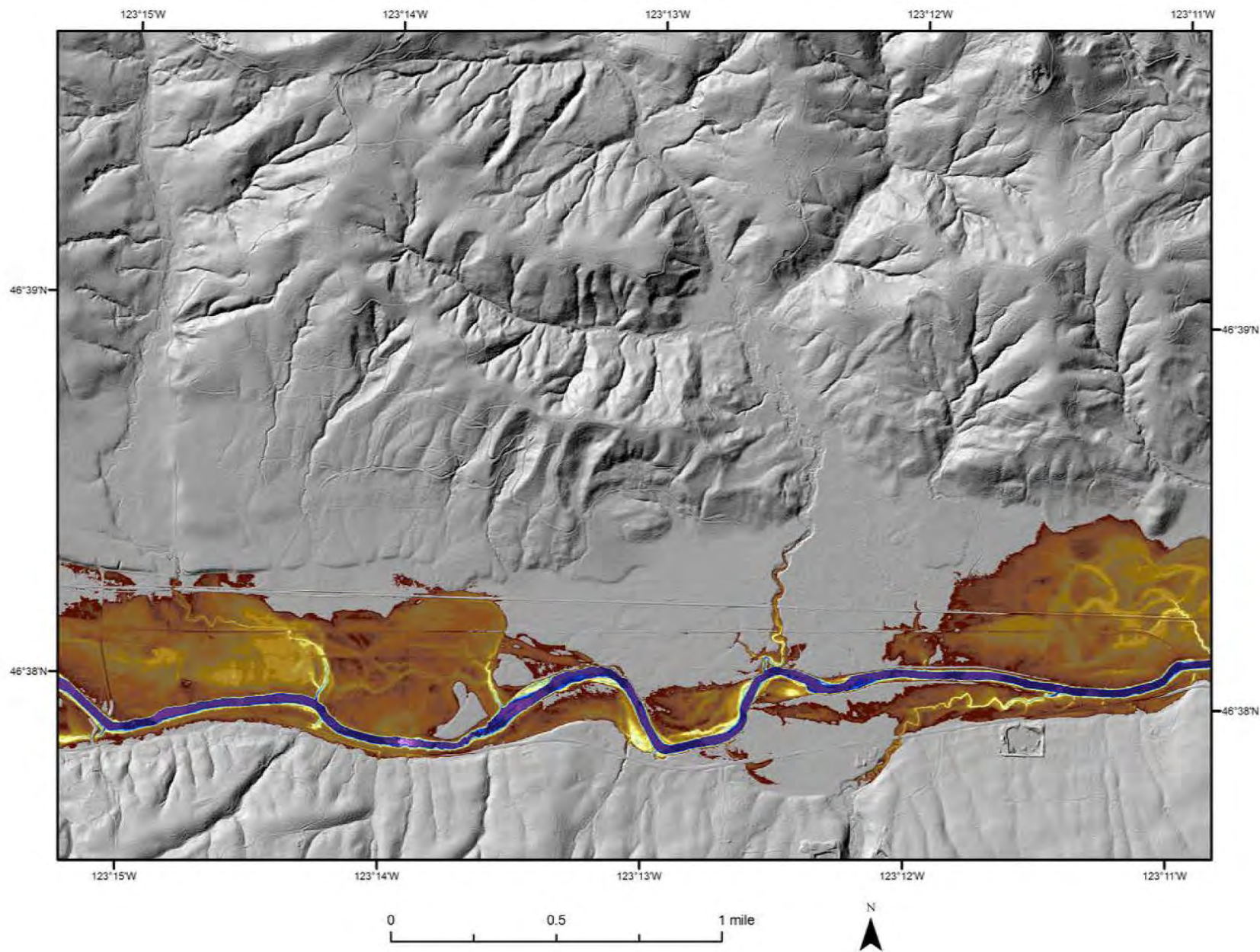
[Click here to return to map index](#)

Geomorphic Features - Map Sheet no. 27



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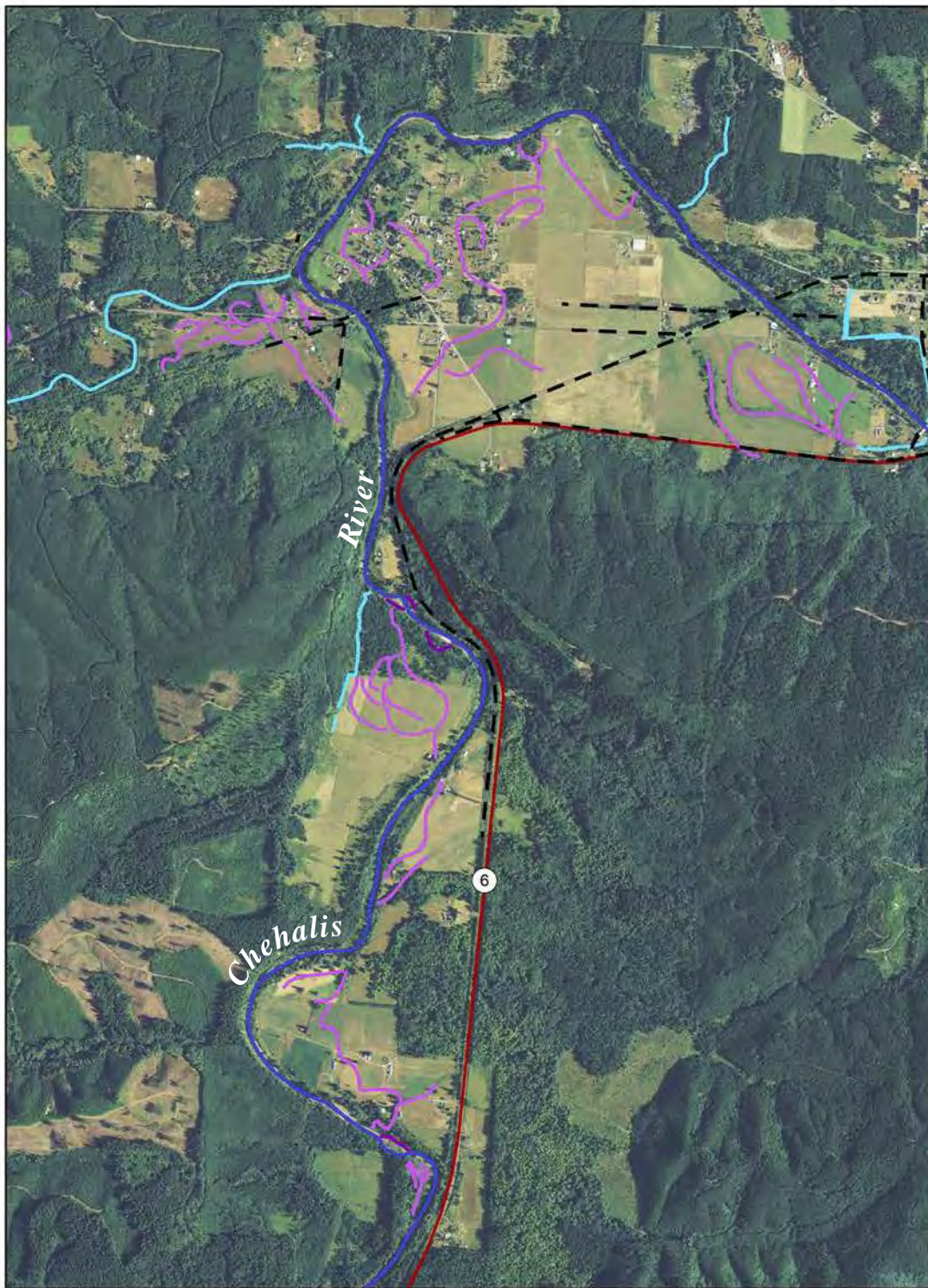
Relative Elevation Model - Map Sheet no. 27



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Geomorphic Features - Map Sheet no. 28

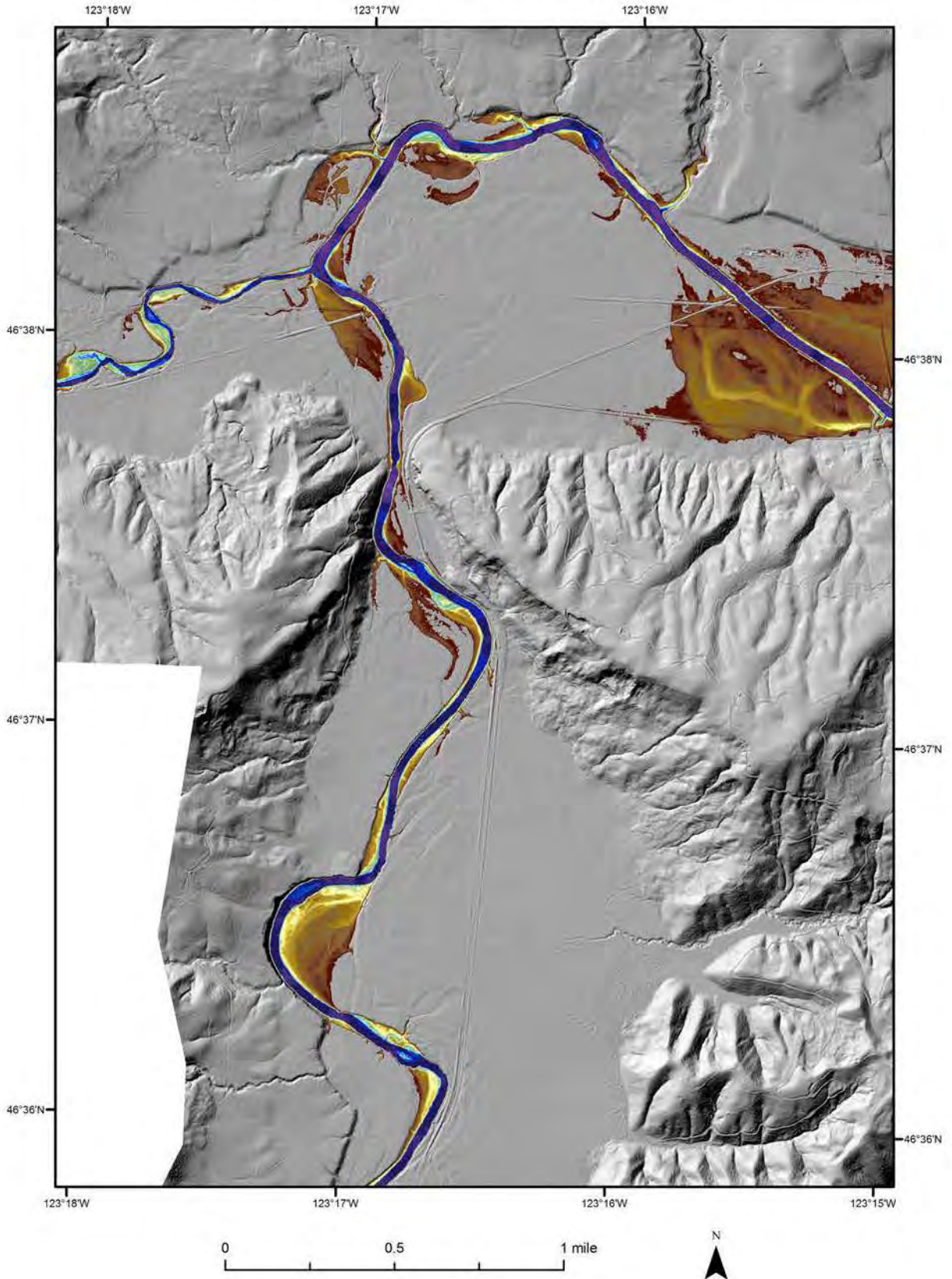


0 0.5 1 mile



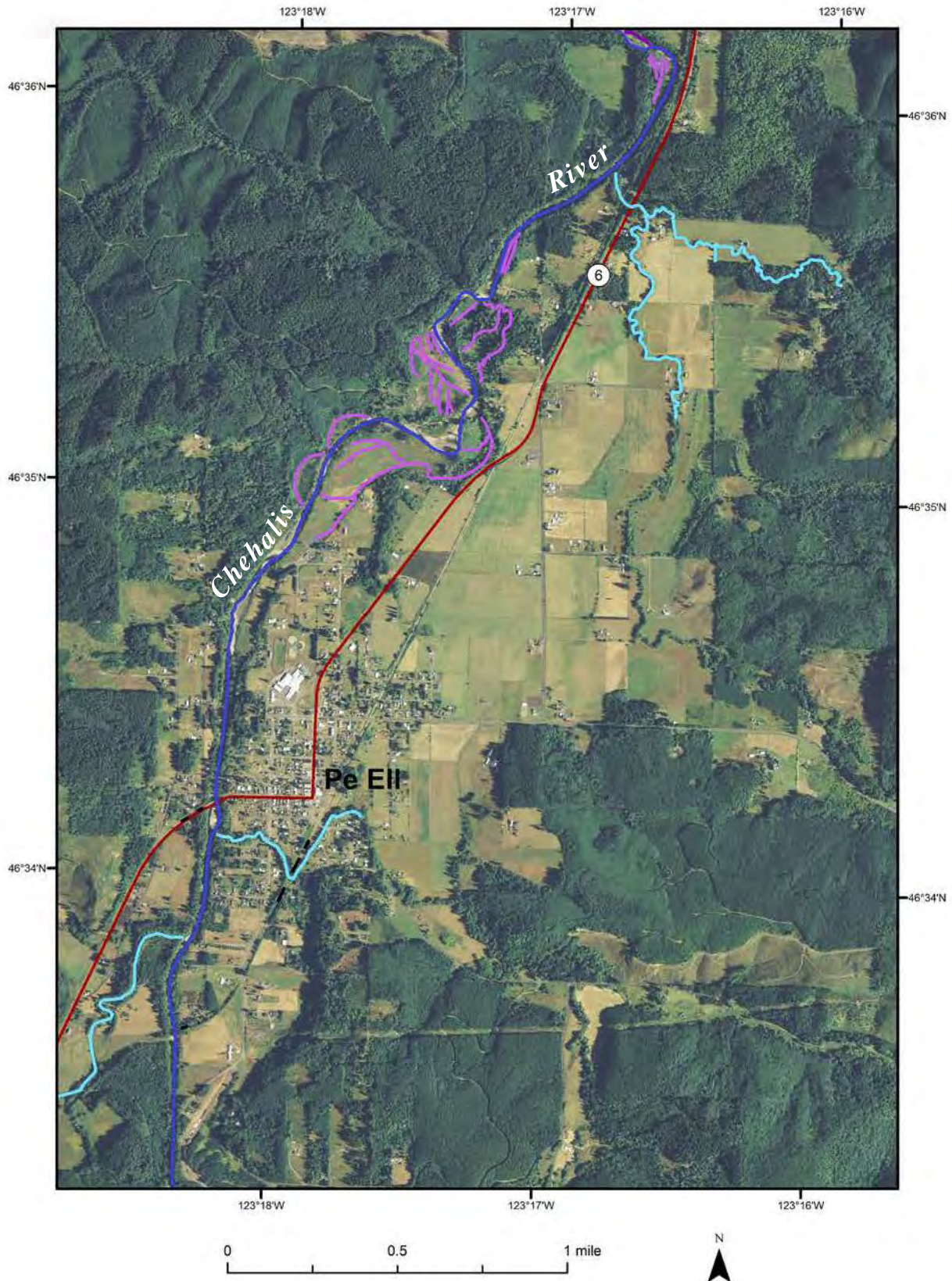
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Relative Elevation Model - Map Sheet no. 28



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Geomorphic Features - Map Sheet no. 29



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Relative Elevation Model - Map Sheet no. 29

