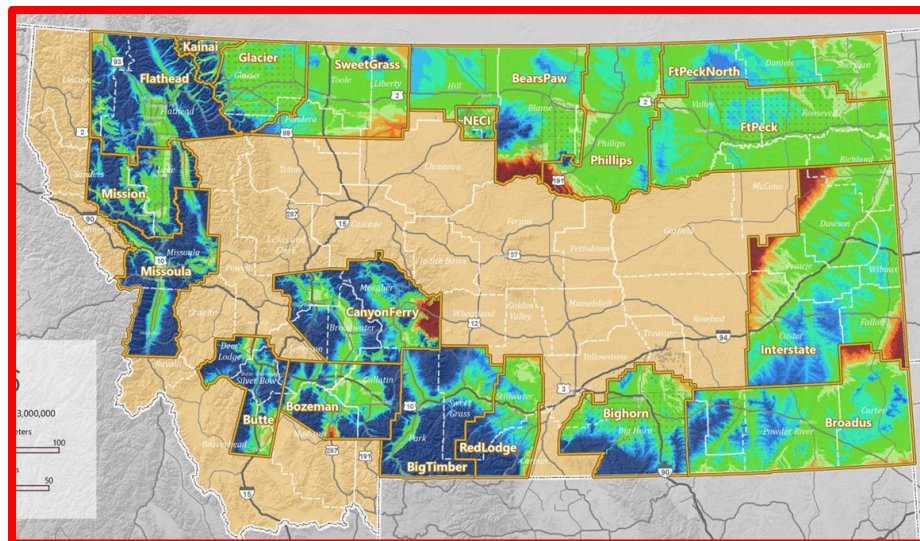


Low Distortion Projections (LDPs) for all Montana??

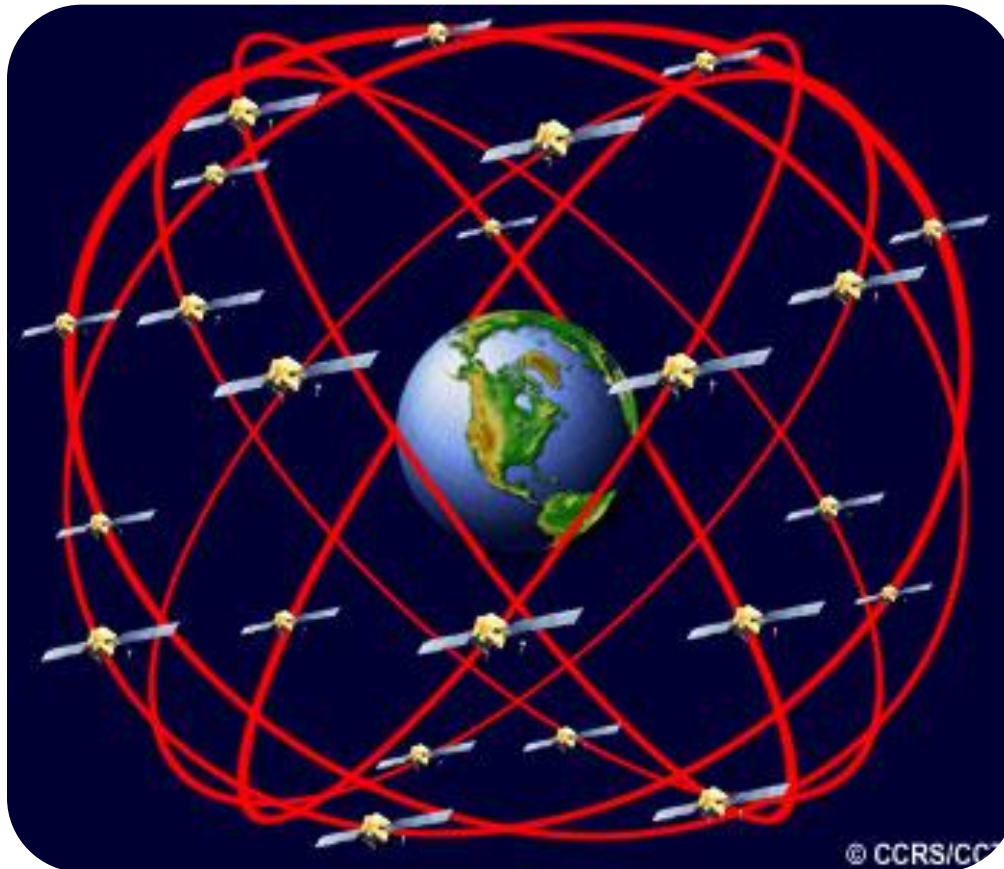
A State Champ is Needed



The problem with GPS

■ Map Distortion

- Earth is round, maps are flat
- If you want to use GPS - Distortion is a Fact of Life



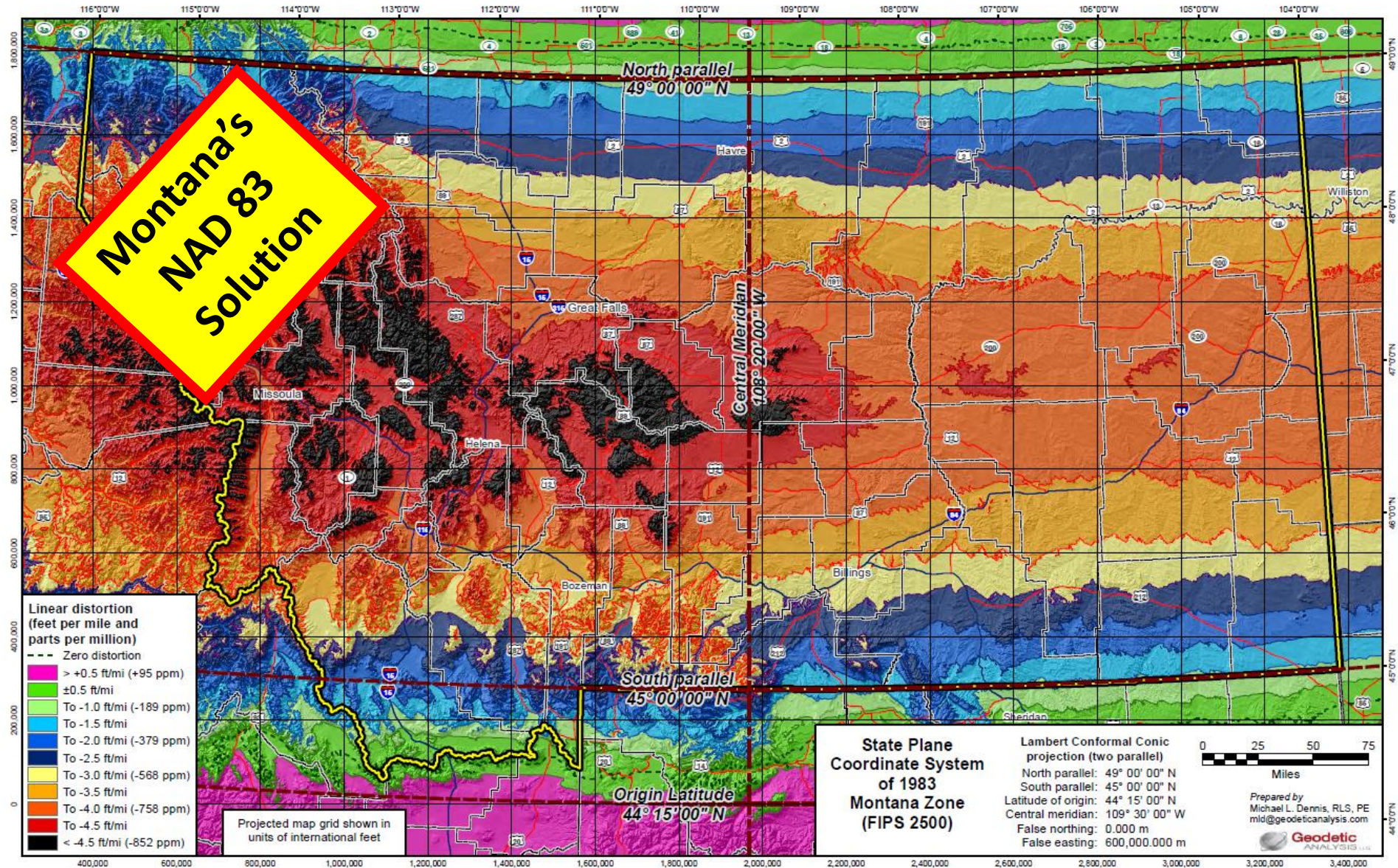
SURVEYORS & ENGINEERS



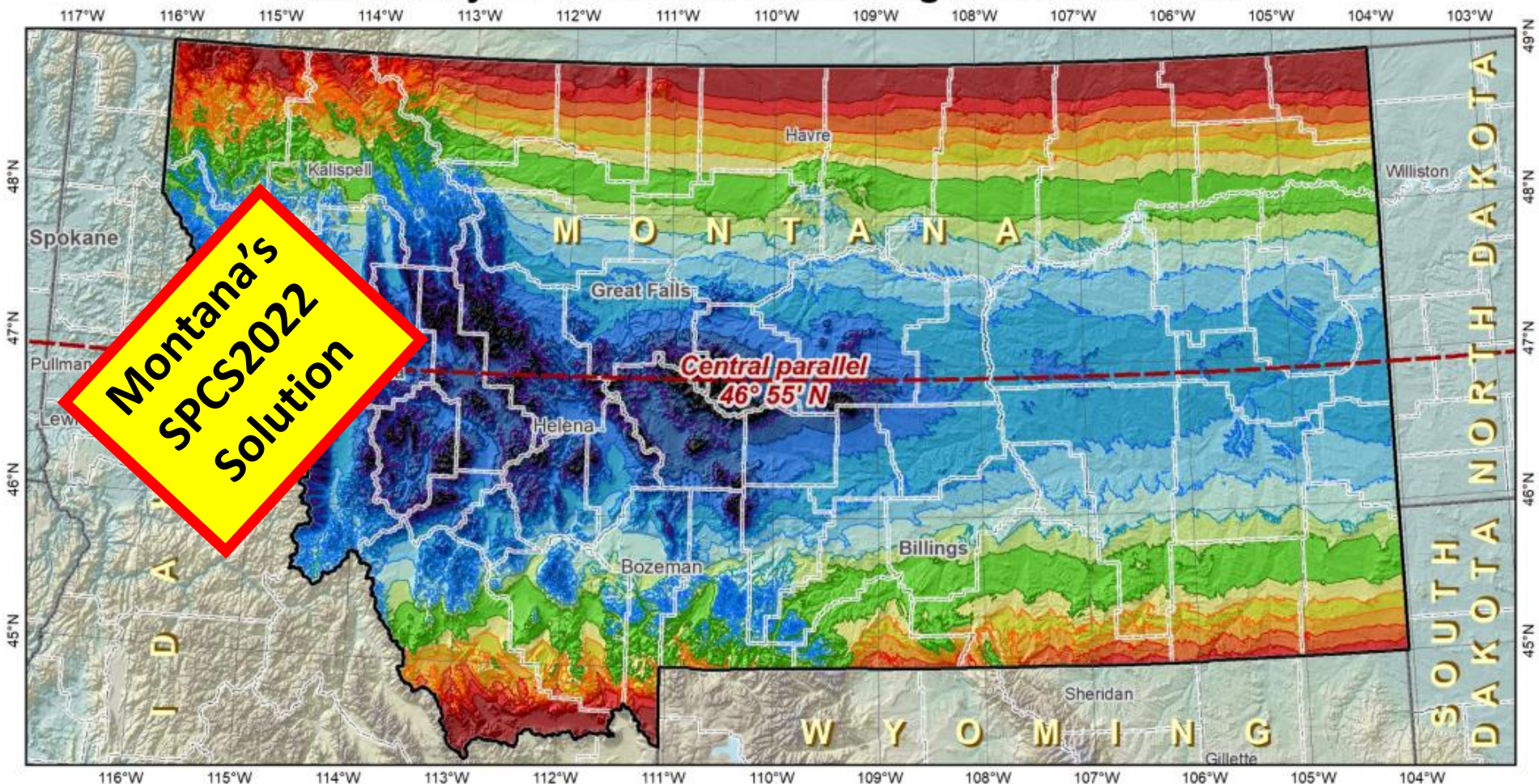
***projected
coordinate systems***

Montana's Solution

MDT's Solution (NAD 83)



Preliminary SPCS2022 default design: Montana Zone



Lambert Conformal Conic projection

North American Terrestrial Reference Frame of 2022

Central parallel: 46° 55' N

Central parallel scale: 0.999 9 (exact)

Areas within ±300 ppm distortion
(±1.58 ft per mile):

- 98% of population
- 90% of all cities and towns
- 83% of entire zone area



NOAA's National Geodetic Survey

Distortion values (ppm)

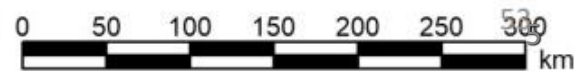
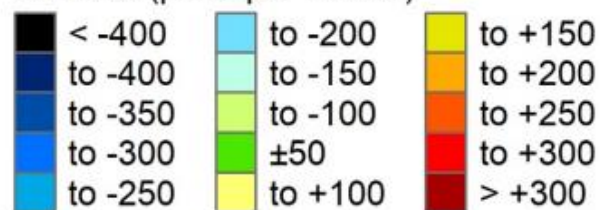
Entire zone:

Min = -534 Range = 1000
Max = +467 Mean = -79

Cities and towns:

Min = -380 Mean = -113
Max = +441 (weighted by population)
Range = 822

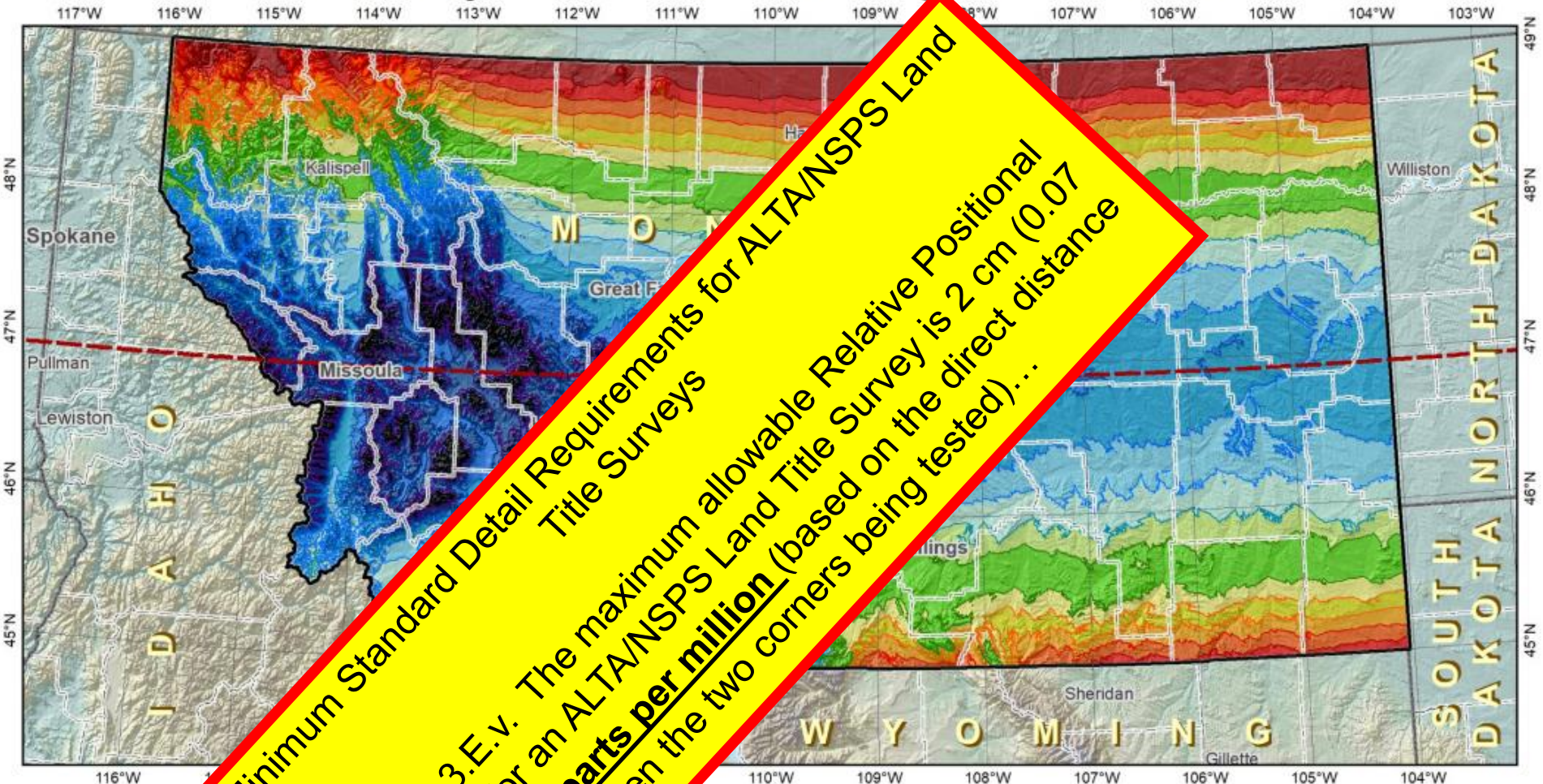
Linear distortion at topographic surface (parts per million)



2019 National Technical Conference

Created 01/13/2019

Preliminary SPCS2022 default design: Montana Zone



Minimum Standard Detail Requirements for ALTA/NSPS Land Title Surveys
 Section 3.E.v. The maximum allowable Relative Positional Precision for an ALTA/NSPS Land Title Survey is 2 cm (0.07 feet) plus **50 parts per million** (based on the direct distance between the two corners being tested)...

Lambert Conformal Conic
 North American Datum of 1983
 Central parallel 46°N
 Cen parallel scale factor 0.9999012

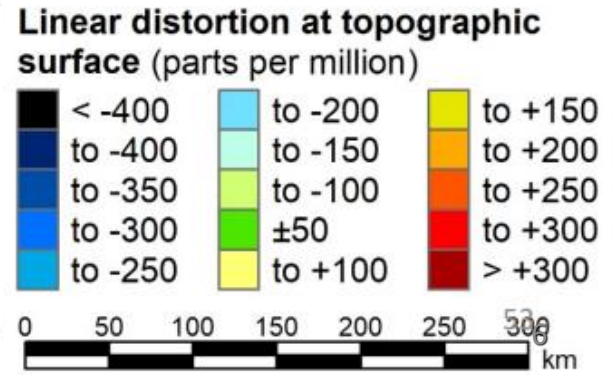


Areas within ±1.58 ft per mile
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 98% of population
 90% of all cities and towns
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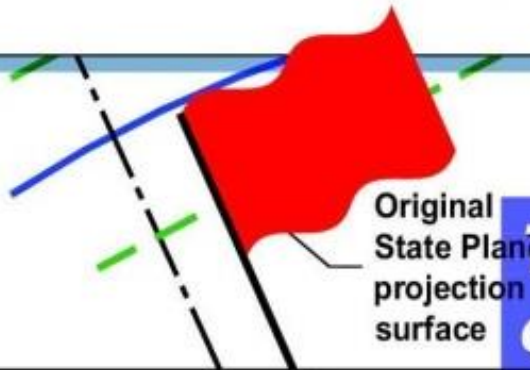
Montana -Modified State Plane

State Plane projection axis
(central meridian for

low-distortion

State Plane

Just say *NO*
to *modified* STATE PLANE



They LOOK like State Plane coordinates . . . but are they?

Preliminary SPCS2022 multiple-zone designs by states (CONUS)

125°W 120°W 115°W 110°W 105°W 100°W 95°W 90°W 85°W 80°W 75°W 70°W

581 zones in 19 states

45°N

40°N

35°N

30°N

25°N

45°N

40°N

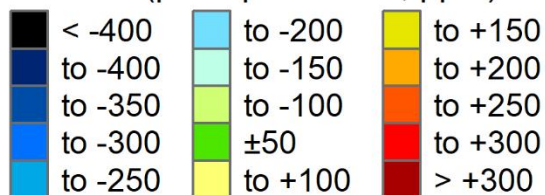
35°N

30°N

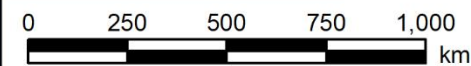
25°N

**Distortion increment 50 ppm
(1:20,000 = 0.26 ft/mile)**

Linear distortion at topographic surface (parts per million, ppm)



Percent area within:
±20 ppm = 84%
±50 ppm = 95%
±100 ppm = 98%
±400 ppm = 100%



Created 12/8/2021 (Michael Dennis)



115°W

110°W

105°W

100°W

95°W

90°W

85°W

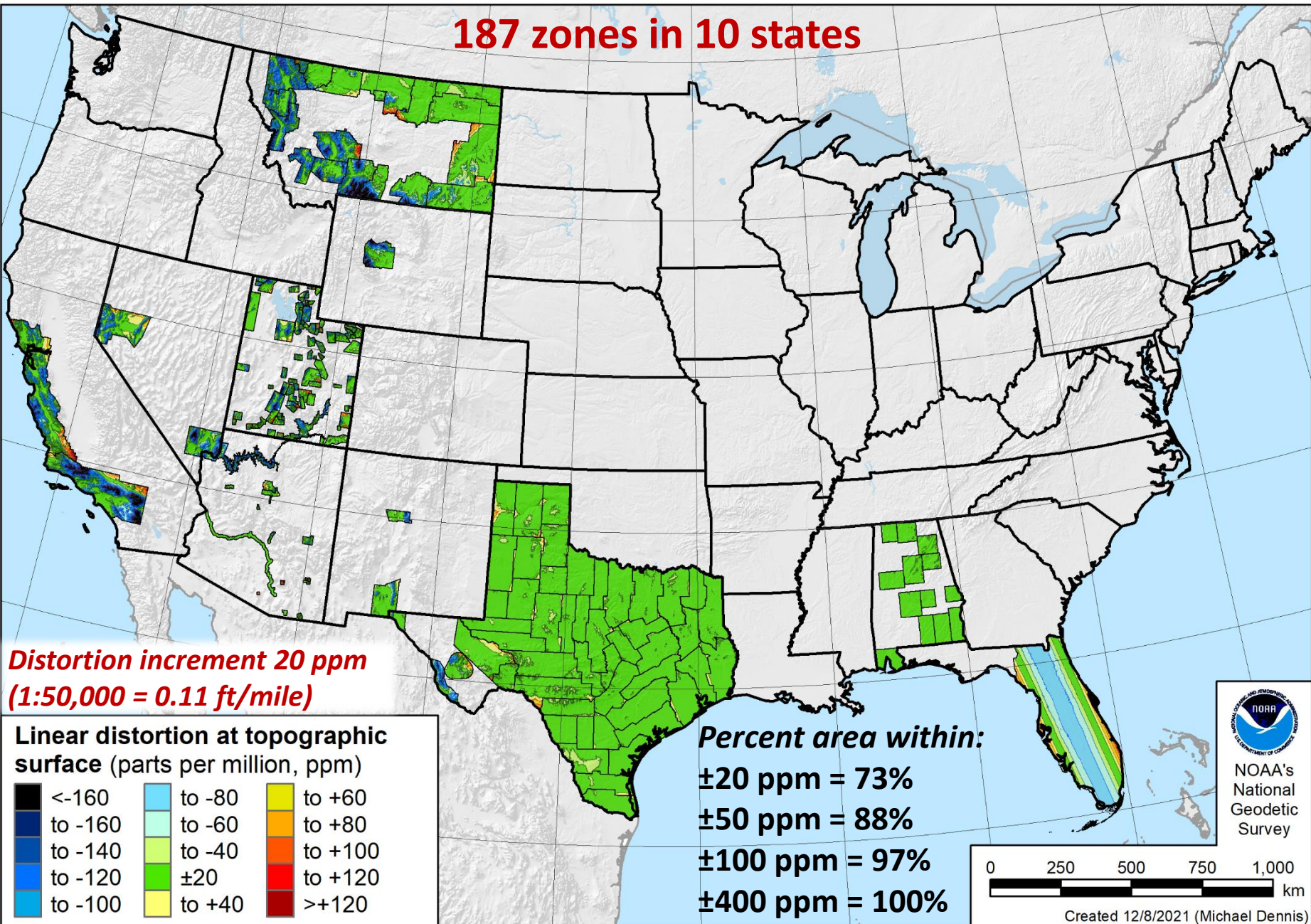
80°W

75°W

Preliminary SPCS2022 multiple-zone partial coverage designs by states (CONUS)

125°W 120°W 115°W 110°W 105°W 100°W 95°W 90°W 85°W 80°W 75°W 70°W

187 zones in 10 states

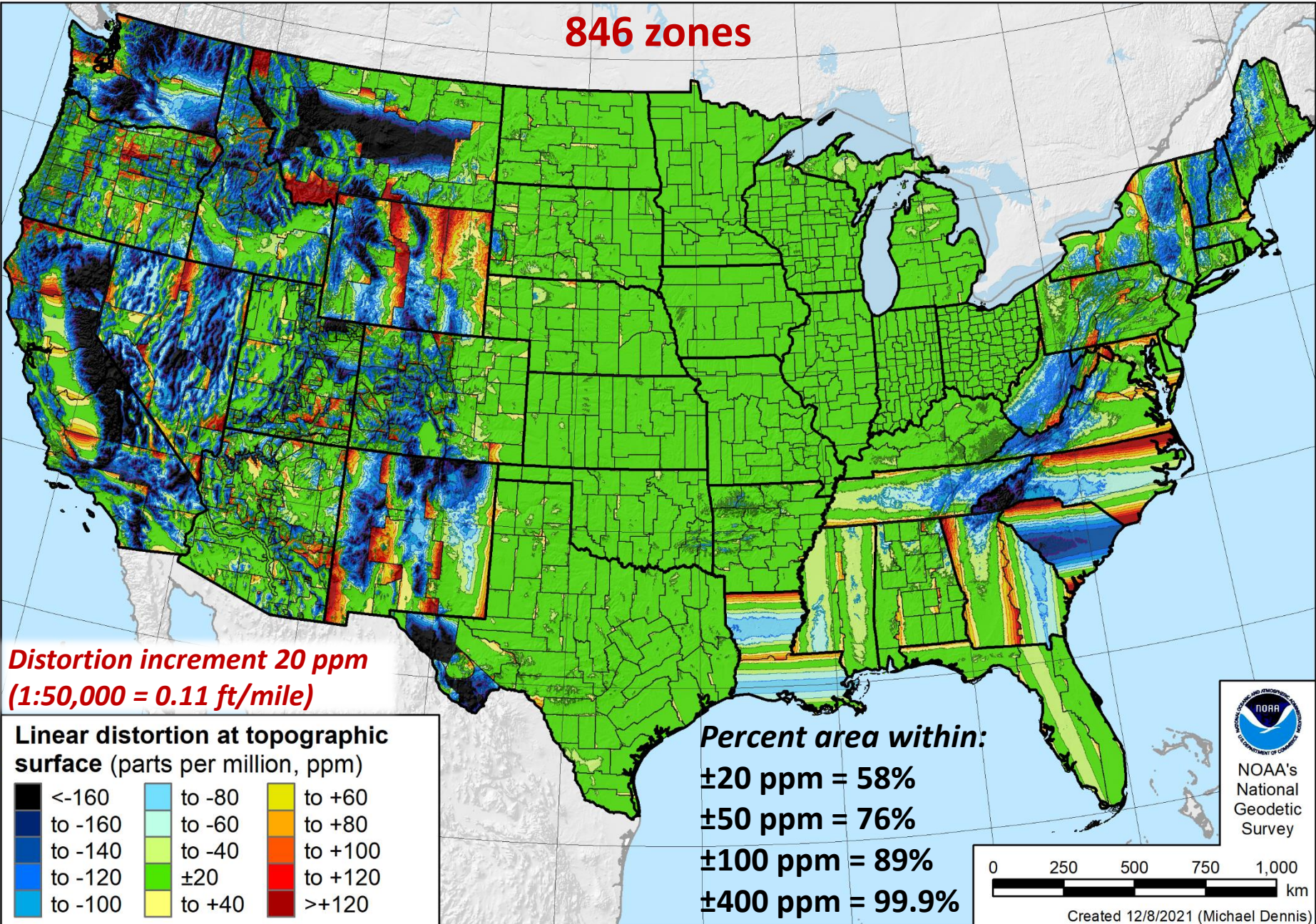


115°W 110°W 105°W 100°W 95°W 90°W 85°W 80°W 75°W

Preliminary SPCS2022 complete and partial coverage designs (CONUS)

125°W 120°W 115°W 110°W 105°W 100°W 95°W 90°W 85°W 80°W 75°W 70°W

846 zones



45°N
40°N
35°N
30°N
25°N

45°N
40°N
35°N
30°N
25°N

115°W 110°W 105°W 100°W 95°W 90°W 85°W 80°W 75°W

Rocky Mountain
Coordinate Reference System
Embed in the Software



esri



Trimble



AUTODESK

Vendor Participation



*Up loadable Projection Files, Drop-Down
Projection Definition Methods*

Data Frame Properties

Feature Cache | Annotation Groups | Extent Indicators | Frame | Size and Position

General | Data Frame | Coordinate System | Illumination | Grids

Type here to search

- National Grids
 - Polar
 - Sphere
 - State Plane
 - State Systems
 - Tribal
 - Montana
 - Wyoming
 - UTM
 - World

Current coordinate system:
No coordinate system.

Transformations...

OK Cancel Apply

Data Frame Properties

Feature Cache | Annotation Groups | Extent Indicators | Frame | Size and Position

General | Data Frame | Coordinate System | Illumination | Grids

Type here to search

- Montana
 - NAD 1983 (2011) RMTCRS Billings (ft)
 - NAD 1983 (2011) RMTCRS Billings (m)
 - NAD 1983 (2011) RMTCRS Blackfeet (ft)
 - NAD 1983 (2011) RMTCRS Blackfeet (m)
 - NAD 1983 (2011) RMTCRS Bobcat (ft)
 - NAD 1983 (2011) RMTCRS Bobcat (m)
 - NAD 1983 (2011) RMTCRS Crow (ft)
 - NAD 1983 (2011) RMTCRS Crow (m)
 - NAD 1983 (2011) RMTCRS East Billings (ft)

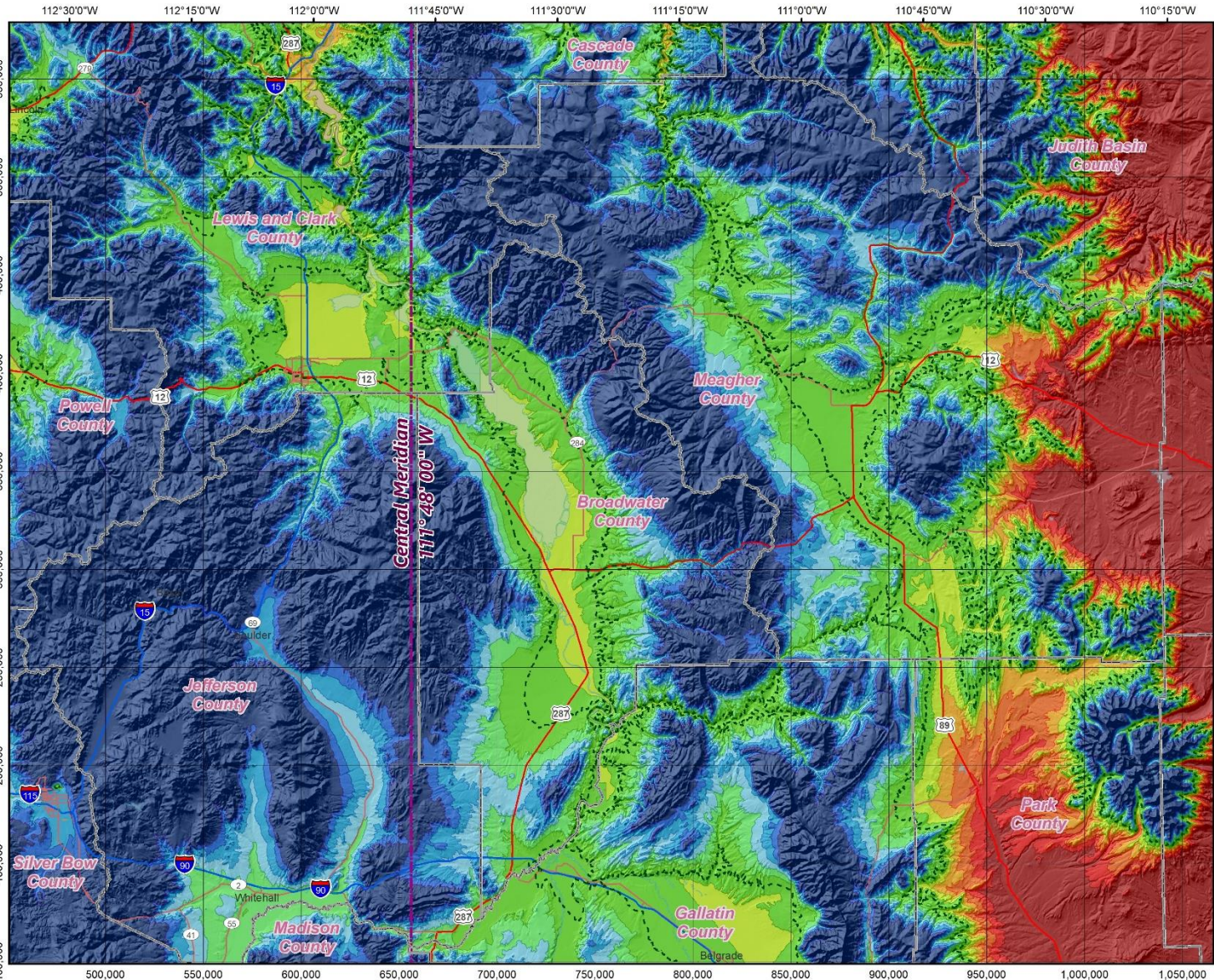
Current coordinate system:
NAD_1983_2011_RMTCRS_Blackfeet_Ft_Intl
WKID: 7120 Authority: EPSG

Projection: Transverse_Mercator
False_Easting: 328083.9895
False_Northing: 0.0
Central_Meridian: -112.5
Scale_Factor: 1.00019
Latitude_Of_Origin: 48.0
Linear Unit: Foot (0.3048)

Transformations...

OK Cancel Apply

Low Distortion Projections (LDP): A Local Solution



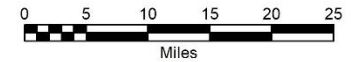
Canyon Ferry 83 Coordinate System

Transverse Mercator Projection
North American Datum of 1983

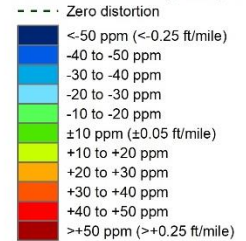
Latitude of grid origin: 45°30'00" N
Central meridian: 111°48'00" W
False northing: 0.000 m
False easting: 200,000.000 m
Central meridian scale: 1.000 188 (exact)

Grid North
Projected map grid
shown in units of
international feet

Scale 1:600,000
(when printed on 11" x 17" sheet)



Linear distortion (parts per million)



This Coordinate System and Map are made possible by the generous contributions of Morrison-Maierle and NECI.

Low Distortion Projections (LDP): A Local Solution

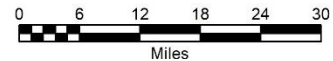
Bobcat Wannabees Coordinate System

Transverse Mercator Projection
North American Datum of 1983

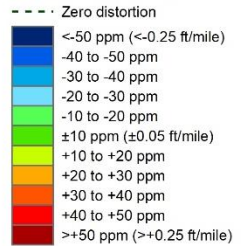
Latitude of grid origin: 45°30'00" N
Central meridian: 114°09'00" W
False northing: 0.000 m
False easting: 100,000,000 m
Central meridian scale: 1.000 158 (exact)

Grid North
Projected map grid shown in units of international feet

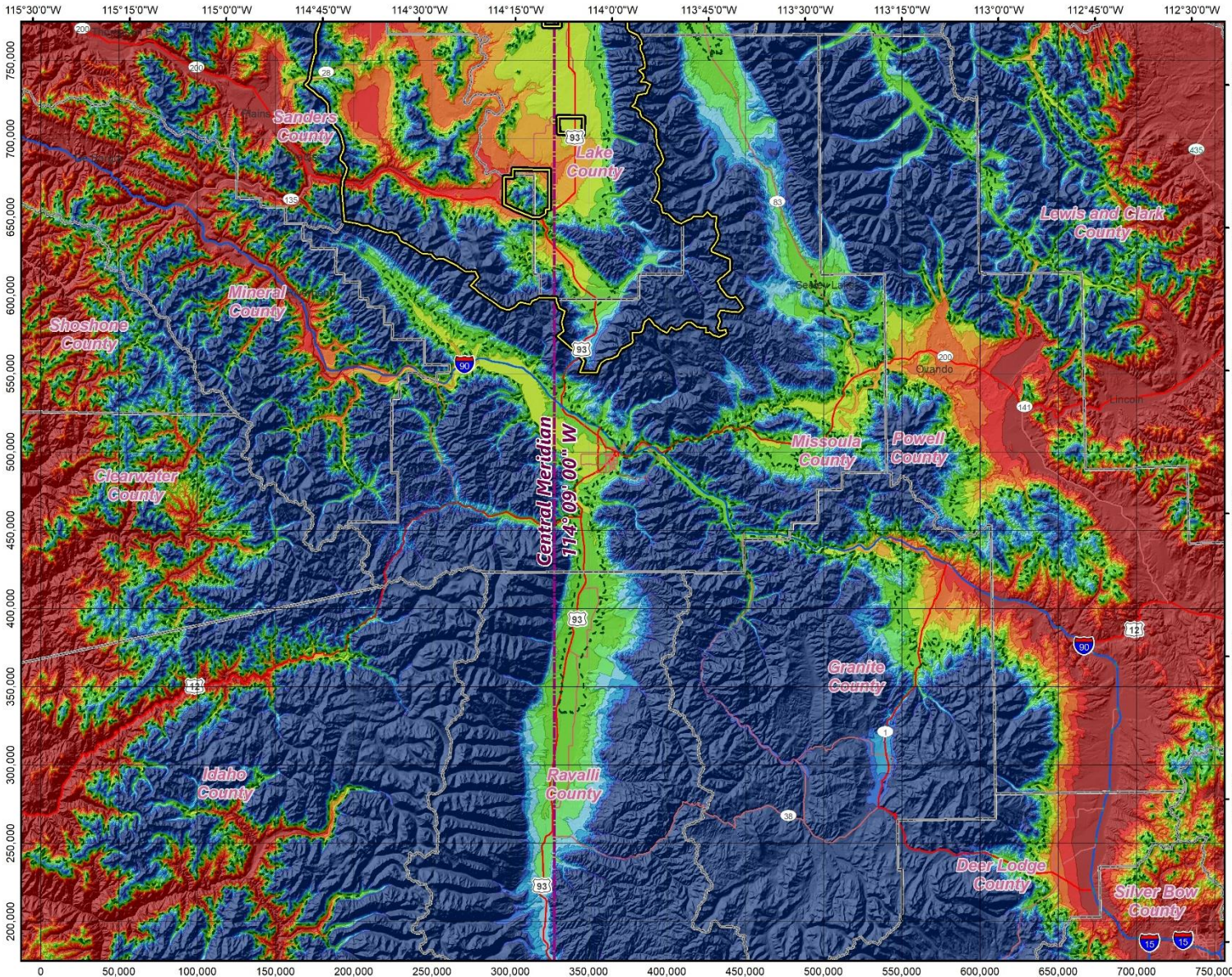
Scale 1:750,000
(when printed on 11" x 17" sheet)



Linear distortion (parts per million)

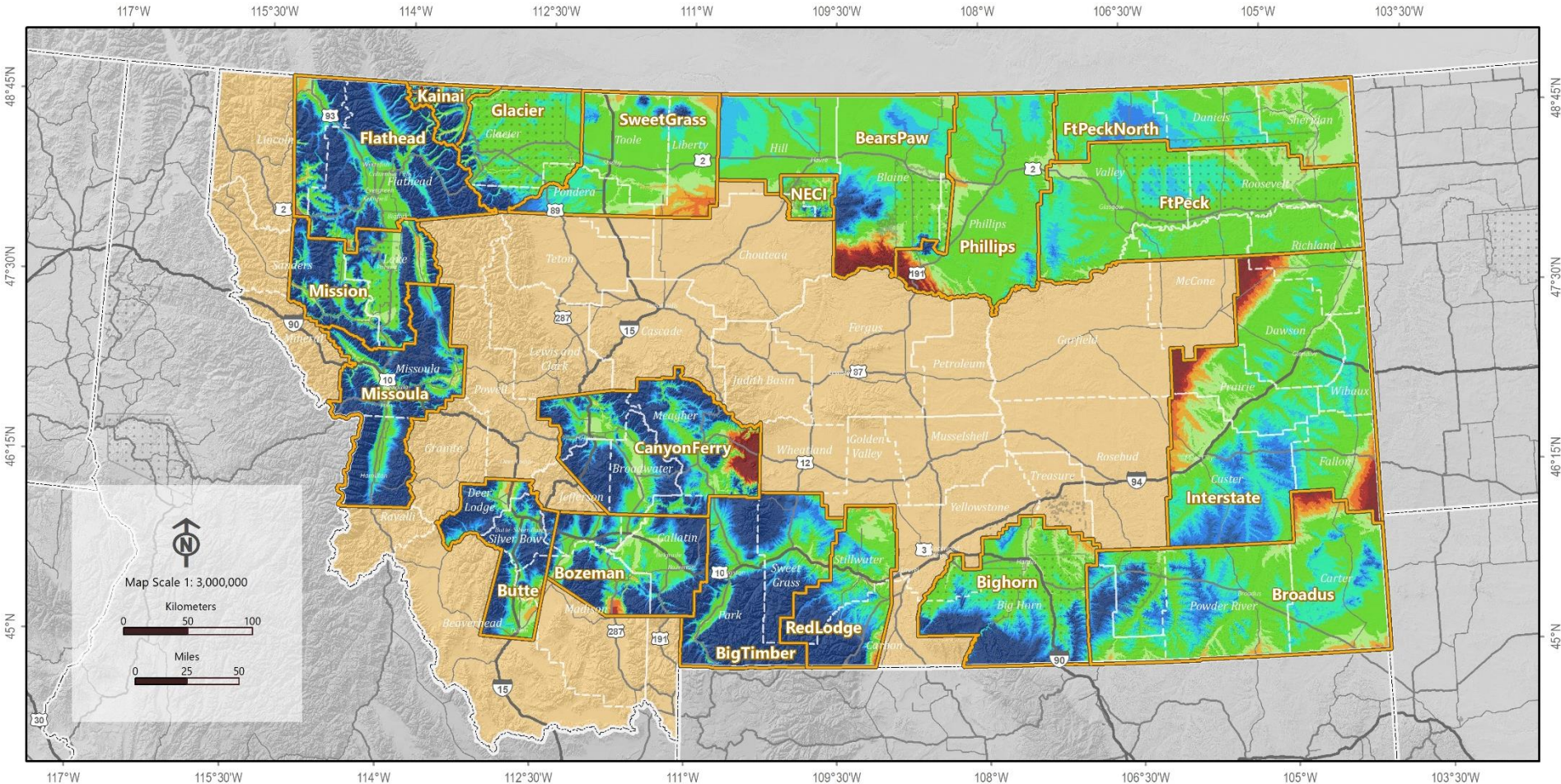


This Coordinate System and Map are made possible by the generous contributions of Missoula County and DJ&A.



Low Distortion Projections (LDP) – SPCS2022

Montana in 2025 or later



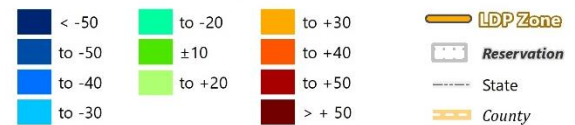
Montana: SPCS 2022 Low Distortion Projections

Funding Partners:



Linear Distortion at the Topographic Surface

in parts per million (ppm)



About the timing of it all...

- **Finalize all designs in 2022**
- **Other things in 2022**
 - Provide machine-readable definitions
 - SPCS2022 report
 - Modify NGS algorithms (e.g., 1-parallel Lambert)
- **Release with rollout of modernized NSRS**
 - Final definitions available in 2022
 - But will not release before new “datums”
 - *Likely after 2025...*

Likely after 2025?

Seriously?

But I want to use my LDP now!



Handbook & User Guide

Download

Montana Association of Registered Land Surveyors (MARLS)

<http://marls.com/>

Resources → RMTCRS Information

Today: NAD83

Rocky Mountain Tribal Transportation Association

Board of Directors

Don White, Blackfeet
Curry Kirn, Fort Peck
Wesley Cochran, Fort Belknap
Howard Brown, Wind River

Dr. Michael L. Dennis, RLS, PE
Geodetic Analysis, LLC
(928) 322-0956



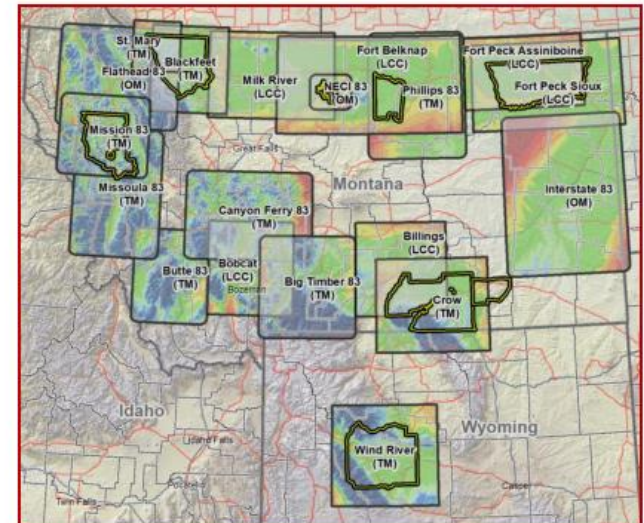
In cooperation with:
Montana Association of Registered Land Surveyors



Rocky Mountain Coordinate Reference System

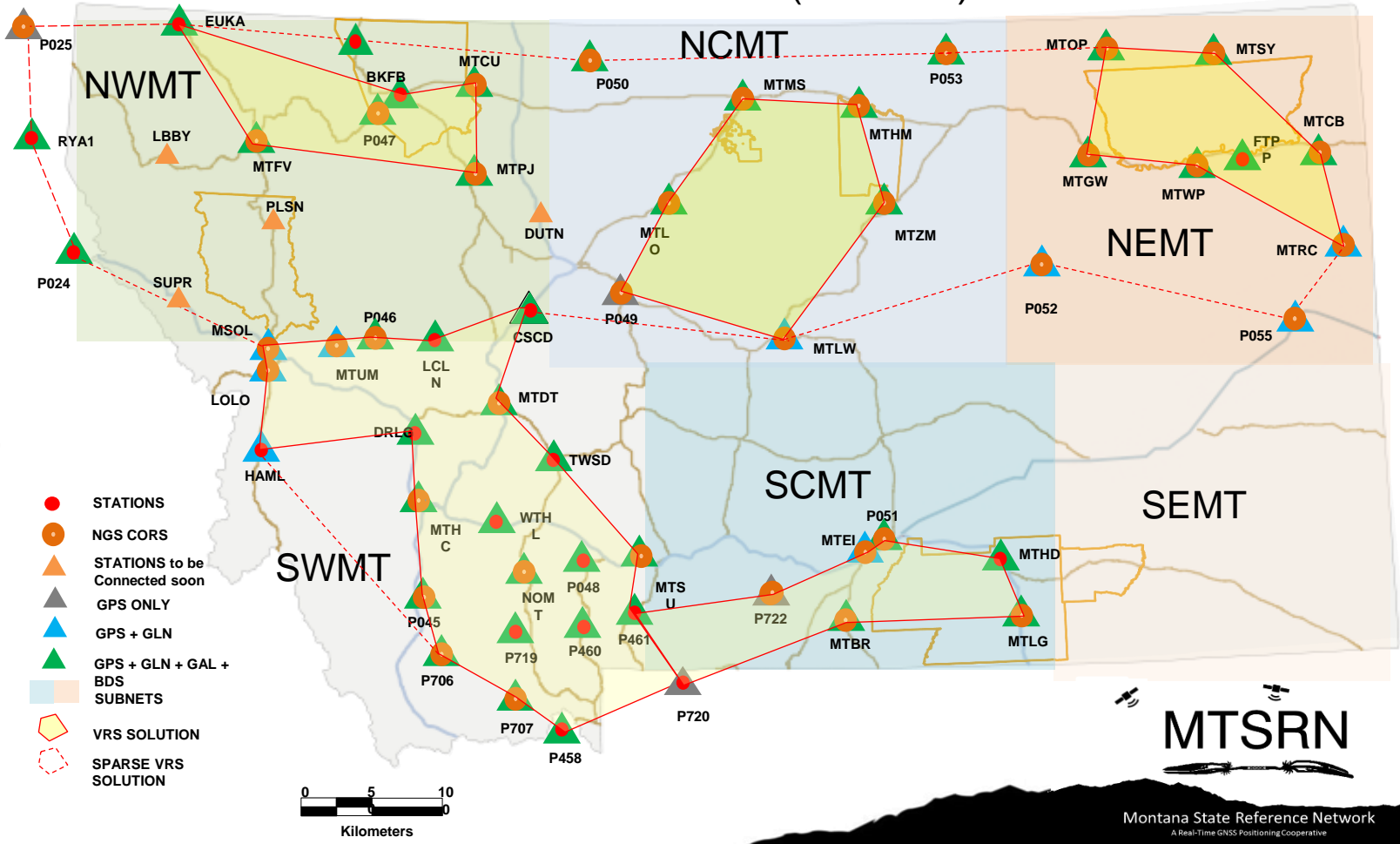
Handbook and User Guide

For
Montana
&
Wind River Wyoming



Version – v2.0
February 23, 2022

Montana State Reference Network (MTSRN) – Pilot www.mtsrn.org



State Champ: MLIA??

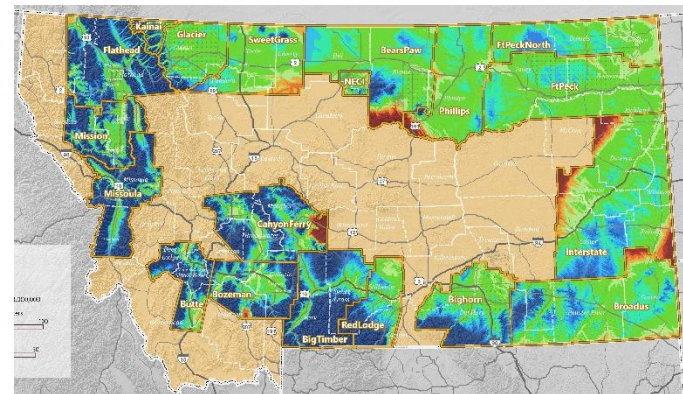
A) Can the MLIA be the steward of the LDPs and the Handbook & User Guide – *Currently consultant managing...*

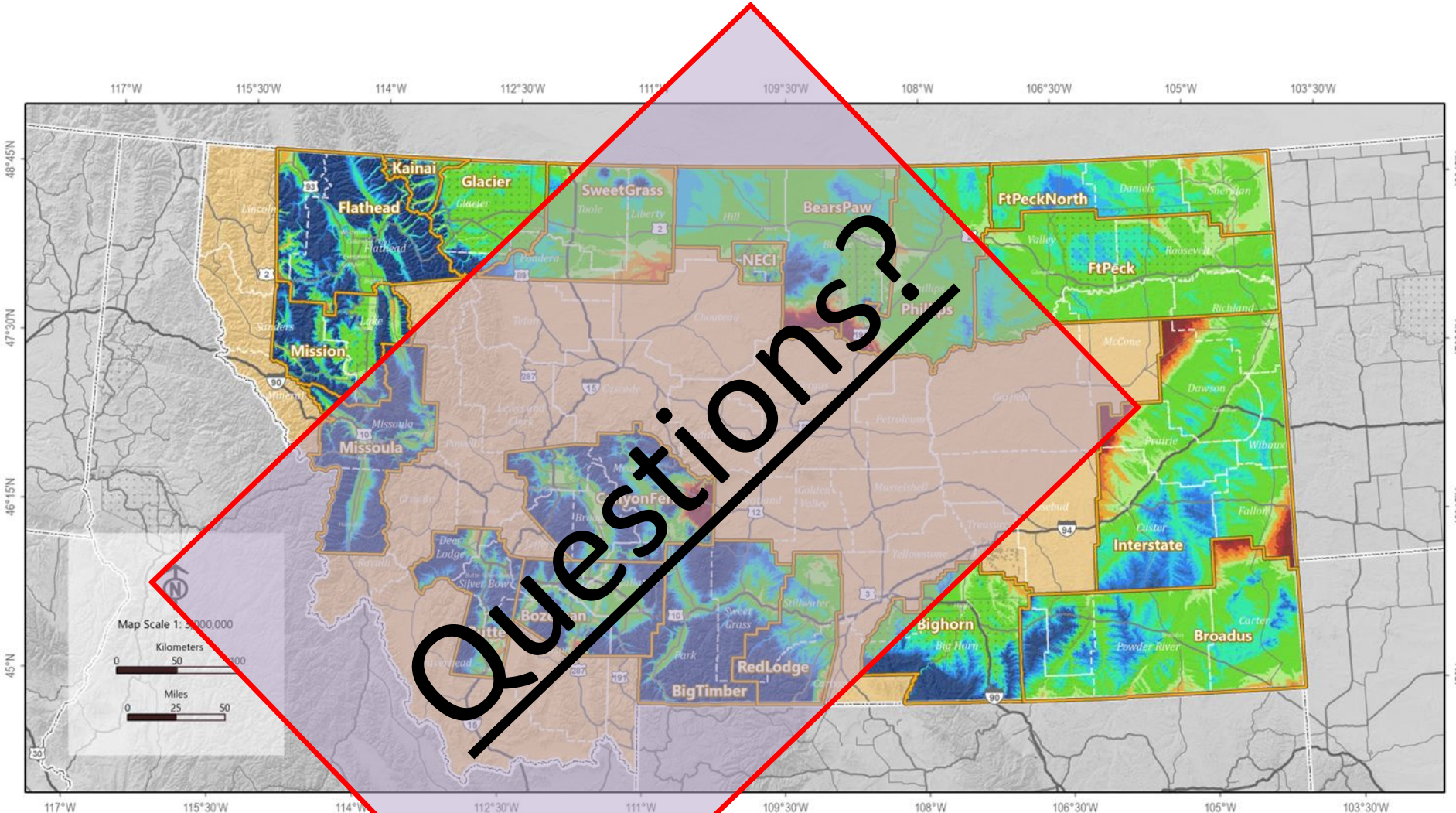
B) Can the MLIA help complete Montana LDPs (Full State Coverage)

* Can the MLIA complete the LDPs internally?

* or can the MLIA provide grants to complete areas of interest:

- Great Falls
- Deer Lodge
- Lewistown





Montana: SPCS 2022 Low Distortion Projections

Funding Partners:

